METROPOLITAN TRANSPORTATION AUTHORITY

Submission to the
MTA Capital Program Review Board
for

LONG ISLAND RAILROAD
•
METRO-NORTH
•
NEW YORK CITY TRANSIT AUTHORITY
•
**STATEN ISLAND
RAPID TRANSIT OPERATING AUTHORITY**

September 25, 1981

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INTRODUCTION

INTRODUCTION

This is the Metropolitan Transportation Authority Capital Program for 1982 through 1986. It is prepared in accordance with the Transportation Systems Assistance and Financing Act of 1981 and represents the program of work to be undertaken over the next five years for the Metropolitan Transportation Authority, the New York City Transit Authority, the Manhattan and Bronx Surface Transit Operating Authority, the Long Island Rail Road Company, the New Haven, Harlem, Hudson and Port Jervis Commuter Services, and the Staten Island Rapid Transit Operating Authority.

It embodies an approach to these problems that includes, but is not restricted to, a series of new financing mechanisms for the purchase of capital equipment and improvement work. It links the new financing to new systems for setting priorities and implementing program improvements. These systems are designed to encompass the complexity of the many problems to be faced, and to be flexible enough to cope with the unforeseen or unpredictable pitfalls likely to arise over so long a period.

The development of this program began in Summer of 1980 when the Chairman of the Metropolitan Transportation Authority asked the staff to prepare a full analysis and report on the status of MTA's capital plant. The result of this effort was the MTA's Staff Report of Capital Revitalization for the 1980s and Beyond, issued in fall of 1980. The purpose of that report was to highlight the physical condition of the MTA systems and to determine the need for an expanded capital investment strategy for MTA and its agencies. Each of the physical components of the various systems was evaluated by analyzing its useful life and developing an optimum replacement schedule and the likely replacement cost. In aggregate, this analysis provided a ten-year program whose objective was to restore the various systems to a condition of "good repair."

Based on the findings of the report, it was determined that the accomplishment of the recommended program would require some $14 billion in 1980 dollars. Of course, that would be a much larger sum in current dollars over the decade.

In addition to establishing the needs, MTA evaluated the funds available at the time and projected their probable continuing availability. Those funds consisted of the contributions from established sources: Federal grants, matched periodically by State bond issues and small direct State appropriations, and a continuing level of contributions through the City of New York's capital budget. On a continuing basis, these sources are expected to provide, at best, some $300 - 400 million per year, while the projected requirements on a continuing basis are well over a billion dollars per year, even after the completion of an initial program to restore the systems.

In order to close this gap, the Chairman of the Metropolitan Transportation Authority proposed a series of new State and Federal financing mechanisms which would add to the funds available for financing capital improvements to the infrastructure of transportation systems of the region. These included bonding secured in three ways:

1. Through the expanded use of surplus revenues of the Triborough Bridge and Tunnel Authority;

2. Through a program of service contracts with the State of New York whereby State appropriations could be pledged to support bonds; and

3. Through the use of MTA general or special operating revenues, fares and/or subsidies, to support MTA bonds.

MTA clearly understood that some of these mechanisms would have the impact of putting additional pressure on operating budget requirements in the future. Nevertheless, it was concluded that historic undercapitalization of all of the systems had contributed to the deteriorating quality of service and that riders will be willing to pay more if they feel that such payments will contribute to improving the quality of service.

In retrospect, it is generally agreed that the capital needs of the transit and commuter rail systems have been seriously underfunded since the earliest history of these systems. These public systems began their existence as private corporate entities, although in the case of the transit system, the earliest capital needs were recognized as a public-sector responsibility. As the region became increasingly dependent on these systems, neither the private operators nor their public regulators could withstand the political and economic pressures to hold down fares. With revenues not growing as rapidly as expenses, a condition arose which can fairly be said to characterize the entire history of transit in the metropolitan region. Management's first response was to reduce reinvestment in capital. This was followed by cutting corners on preventive maintenance and finally by reductions in service itself. In the long run, however, the most serious consequence of undercapitalization was the deterioration of service. The policy of disinvestment, departed from only sporadically when impending crises produced short-lived recognition of the need for capital investment and another bond issue, led to the deplorable condition of the system which most of us experience today.

In January, 1981, State legislation was introduced at MTA's request to revive the capital program of the Metropolitan Transportation Authority and its affiliated agencies. This bill provided not only new funding, but dealt also with the process by

Without the Administration's active support for these proposals, we have been unable, as yet, to secure their adoption. However, Congress did enact a portion of MTA's tax proposal as part of the Economic Recovery Tax Act of 1981, thus opening new opportunities to marry through a lease transaction the proceeds of MTA's own borrowing with private capital to generate additional levels of resources for the program as a whole.

The funding estimates represent a conservative approach to the money that can be expected from current funding sources or resulting from new legislation or other basic changes in the modes of MTA funding. It should be understood that there are serious risks and uncertainties associated with the projected financing plan. In the worst case, a total closing of the tax exempt bond market would devastate the program. Federal aid could be jeopardized if further cuts are made in the Federal Budget over the next five years. The best case, of course, would involve additional funds from federal, state and local grants to finance our capital needs in lieu of borrowing, thus reducing the impact on operating expenses. Given these uncertainties, MTA believes it has provided a reasonable basis for its Five Year Plan. The supplement on Financing Strategies reviews these issues in greater detail.

While this plan is defined in terms of funding that is now likely to be available, additional funding will continue to be sought from existing as well as new sources. The availability of such new funds will make it possible to achieve further progress toward fulfilling the aggregate needs of the system.

In order to assure the best use of the funds that will become available, MTA developed a capital project priority-setting process consisting of three basic steps: an estimate of existing and new funding, a priority evaluation system, and a detailed list of projects with estimated costs.

While this may seem a simple task, it is a relatively new process for the MTA, which has to date been too seriously underfunded to be concerned with anything but the most critically needed emergency projects.

As a guide in evaluating capital projects, MTA has also developed what it calls a Capital Value Matrix. This was originally developed by the NYCTA in order to document more adequately an existing, although informal project selection process. The procedure has now been adapted, with some modifications, to meet similar needs in the commuter rail program.

The Matrix considers such factors as safety, reliability, security, maintainability, passenger comfort, economics/cost control, and public and employee concerns. A numerical value is assigned for each factor, including a weight for its relative importance. Their sum becomes the project's rating. While the ratings are an important guide in project selection, the final

priority order of projects is further refined by the incorporation of individual and more intuitive understandings based on staff experience and on public response.

Finally, the matrix analysis is only one part of an overall program review process which takes into account economic appraisals as well as other considerations. For instance, one question that is asked is: "Does this program serve all those who have a community of interest?" Most importantly, there is overriding concern with whether a project contributes to the entire program working as a whole. Issues addressed in this regard include:

- Does one program's success depend on another's?

- Can all the components be accomplished within the five-year period?

- Can service continue to be provided while this program is underway?

Based on the combination of funding availability and the final rating of projects, MTA has developed lists of projects in program categories. Included are back-up projects that will be advanced only should a level of funding higher than anticipated become available. These project lists reflect what are believed to be realistic expectations for construction scheduling and projected inflation over the construction period. Each year's program level is designed to represent the value of commitments, i.e. contracts, which will be entered into in that year. Program priorities also suggest what areas can be curtailed if funding is reduced.

The section that follows contains the two plans required by State legislation. The first covers the proposed program elements for the New York City Transit Authority, the Manhattan and Bronx Surface Transit Operating Authority and the Staten Island Rapid Transit Operating Authority. The full plan has sections describing 38 program elements and a section describing the projected financing to support that program on an annual basis. The second plan is for the Long Island Rail Road and the Metro-North Commuter Service, and it is similarly divided for each of them into a series of program elements. Also included is a financing program for the commuter rail plan.

A third section contains supplementary information for those who will review the program. It includes details which are not part of the formal plans, as well as a statement of projected financing strategies for the next five years. The strategies indicate, for example, the general sources of funding that MTA now intends to deploy for particular purposes.

This is provided as supplementary information rather than as part of the plans because it is considered important to maintain

flexibility in relation to regulatory, requirements, appropriation levels, and financial and economic market conditions which may change during the program period. The advantages and risks associated with the current strategy are outlined in the supplementary information.

HIGHLIGHTS of the MTA FIVE-YEAR CAPITAL PROGRAM

Each plan contains a program of work to be undertaken over the next five years:

New York City Transit Authority

The capital plan for the Transit Authority begins with a program emphasis on the purchase of new subway cars, and calls for an expenditure of $1,749 million to purchase 1,150 new IRT cars and 226 new IND/BMT cars. This program includes $345 million of previously authorized funds which are being used to fund the purchase of approximately 325 IRT cars.

The reliability of the system is further enhanced by a program to rehabilitate existing cars. This portion of the program calls for an expenditure of $371 million, of which $329 million would be used for a continuation of the CORE program and $42 million for car door modernization, prototype for an air-conditioning retrofit program, and an overall car safety program for existing 75 ft. cars.

The bus replacement program projects an expenditure of $312 million to purchase 1,605 buses. At the completion of the five year program the number of buses of 12 years or more of age will have been reduced from 1,500 to 573. Up to 50% of the fleet will be accessible to the elderly and handicapped.

$309 million is allocated for a program to begin to improve the passenger environment in subway stations. $227 million of this is to accomplish the total rehabilitation and modernization of some 50 stations throughout the transit system. The balance, $82 million, is to replace overage escalators and elevators and to replace roofs, canopies, turnstiles, lighting and signage, and to complete the installation of abrasive warning strips at all stations.

The track and rail section of the program represents a proposed expenditure of $365 million, of which $267 million will be used to rehabilitate main line track, contact rail and track switches. $89 million is for the continuation of a noise abatement program by the installation of welded rail and rubber rail seats.

The line equipment program, totalling $97 million, will begin a longer range campaign to extend tunnel lighting, and to rehabilitate pumping facilities, ventilating facilities, and power facilities.

The program relating to the line structures of the system calls for an expenditure of $199 million, with $141 million to repair elevated and on-grade structures and $58 million allocated for dealing with adverse water conditions and for the replacement of wooden platforms and fire and water lines.

The capital program calls for an expenditure of $500 million for signals and communication requirements. $439 million is to begin the replacement and modernization of the signal system. $61 million is to begin the modernization of the telephone and other voice communication systems.

The section of the program dealing with the power distribution system calls for a total expenditure of $301 million, of which $260 million is to replace and modernize antiquated substations on the IRT/BMT system, some of which date back to the early 1930s. $41 million is to re-equip IND substations with more modern and reliable equipment.

The proposed expenditure of $432 million will advance a continuing effort at rehabilitating shops, replacing outmoded and inefficient mechanical equipment, maintenance-of-way machinery, and the rehabilitation of employee and shop facilities.

Subway yards represent an expenditure program of $350 million, of which $106 million is to initiate a yard expansion program which will assist in improving the appearance and reliability of the rapid transit fleet. $244 million is to rehabilitate and generally upgrade existing yard facilities.

Bus depots are among the major constraints to improving the reliability of the bus fleet. This program calls for an expenditure of $308 million, of which $225 million is to construct five new depots. $83 million will be used to rehabilitate, modernize and/or re-equip ten existing depots.

$53 million will be used to replace maintenance equipment machinery, automotive trucks and service vehicles and required work trains, while $21 million will be used to continue the program of station communications and making improvements to "protected" waiting areas.

The new routes construction program will be brought to the point where subway operations will be possible on two new segments of the rapid transit system. $180 million will be used to complete the Hillside Avenue connection and the Archer Avenue

connection in central Queens and to complete the 63rd Street line to 21st Avenue in Queens.

The total program calls for an expenditure of $239 million for miscellaneous and emergency needs. $20 million is to be spent for upgrading the management information systems throughout the Authority. $219 million is to be spent on a variety of miscellaneous and emergency projects as the need arises.

Staten Island Rapid Transit Operating Authority

The total program for passenger stations calls for an expenditure of $5.8 million. The stations at Pleasant Place and Princess Bay Place will be rehabilitated, and various platforms will be extended.

Track and third rail will be replaced at various locations and the "Wye" at St. George will be realigned at a total estimated cost of $2.3 million.

An expenditure of $3 million is projected to replace the Tottenville interlocking, while $11 million will be spent in providing additional power for more reliable operations.

$600,000 will be used to replace various machine tools, $300,000 will be spent to replace cyclone fencing, and $1.9 million is provided for miscellaneous repairs and emergency needs.

The Long Island Rail Road

The Long Island Rail Road five-year plan totals $683 million. $252 million of that amount is identified for new cars. It is projected that a total of 216 new M-3 electric cars can be acquired for the Long Island Rail Road. Seventy of the 216 are already on order, funded by the 1979 Bond Issue.

The goal of providing the new cars is ultimately to relieve the overcrowding that currently exists. It is interesting to note that in terms of peak hour arrivals at Penn Station there has been a 37% increase over the last ten years. It is estimated some 9,500 commuters now stand for from twenty to sixty-five minutes.

The five-year program calls for $31.2 million for passenger stations. $16.2 million is to make improvements at various stations. Those improvements will include rehabilitation of escalators, improved signage and lighting, access for elderly and handicapped persons and platform extensions.

$15 million of the program funds will be spent on Penn Station passenger facilities. In addition, $8 million from other sources will be used for Penn Station improvements. These improvements will include air-conditioning, installation of new escalators, elevators and a new West End Concourse to relieve overcrowding at the west end of all LIRR platforms.

The LIRR will be spending $75.9 million to increase capacity byt adding a second track from Syosset to Northport and from Republic to Ronkonkoma. The additional track will improve reliability and permit reverse commuting, which is not presently available during the peak travel periods. The LIRR has, in addition, allocated $35.7 million to extend the electrification of the Port Jefferson Branch from Huntington to Northport. Included in this program are new, 12-car high-level platforms and a modern electric/diesel transfer facility at Northport.

$67.2 million will be spent to modernize the interlockings at Jamaica, install centralized control of those Jamaica interlockings, modernize the switches at Penn Station, centralize their control at one location, and increase the capacity of the interlocking at Divide (Hicksville).

To install reverse signals on the four tracks between Jamaica and Penn Station, upgrade the flexibility of the interlocking at Harold and make signal improvements on the Montauk Branch east of Babylon, $28.5 million is allocated.

The five-year program allocates $159 million for shop and yard improvements on the LIRR. In addition, previous funding sources will provide $76 million in additional funding for shop work and $54 million of additional funding for the West Side Storage Yard.

The shop program will complete the first three phases and begin the fourth phase of a ten-phase shop program. The initial efforts of this program will be directd toward improving the comfort and reliability of the diesel car fleet. The West Side Storage Yard will make it possible for the LIRR to operate as many as 25% additional trains into and out of Penn Station and to eliminate the wasteful practice of shuttling trains back and forth across the length of Long Island each day.

The program to improve security for both the traveling public and the Long Island facilities represents a commitment of $3 million. This program includes fencing, lighting and CCTV. $30 million is allocated for emergency and miscellaneous programs.

Metro-North Commuter Service

The Metro-North Commuter Service has allocated $277.5 million for the purchase of new cars. Of this amount, $164.5 million is to purchase 142 new electric cars for Hudson and Harlem service, 60 of which were ordered with funds from the 1979 Bond Issue. Also, $71.6 million is allocated for the purchase of 44 new electric cars for our New Haven service. In addition, ten SPV rail diesel cars at a cost of $12 million have also been ordered using funds from the 1979 Bond Issue.

$29.4 million has been allocated for rebuilding cars. This program includes the rebuilding of 24 series 4400 cars and the re-equipping of seven FL9 locomotives. This equipment will be used to improve service on the Upper Hudson. In addition, in conformance with U.S.E.P.A. regulations, money has been allocated for the replacement of transformers on existing M2 cars. In the event that regulatory changes permit the transformer program to be deferred, it is our intention to rebuild surplus electric cars to serve our ridership more adequately.

In the program of work on passenger station improvements, $17 million of a program total of $23.3 million, is to provide high level platforms as part of the Upper Harlem Electrification Project. The balance of funding is for other improvements including access facilities for senior citizens and disabled passengers.

$29.2 million will be used to make improvements to interlockings at Brewster, North White Plains, Mott Haven, Shell and Pike on the New Haven Line, to make track improvements between Harmon and Poughkeepsie, and to continue general bridge and tunnel rehabilitation programs.

$74 million has been allocated to install cab signalling on the Harlem and Hudson Lines. With the completion of this program, the entire signal system will have been rehabilitated and modernized with the exception of the section between Grand Central Terminal and Mott Haven which will be done during the next five-year period.

Among the most significant elements of the Metro-North plan is a program to modernize the power distribution facilities, totalling $193.5 million. Of this amount, $190 million is to construct approximately 30 new substations to replace existing antiquated and obsolete substations, most of which were placed into service prior to 1925. $2.5 million is to be used to make interim repairs to the Cos Cob substation and $1 million is set aside for a survey of the conditions of the existing catenary system on the New Haven Line.

$35.2 million has been allocated for shop and yard improvements. The Harmon Shop will undergo a $20 million improvement program, $10 million of which had been provided through the proceeds of the 1979 Bond Issue, while $10 million is allocated from this program. In addition, work will be undertaken to provide or upgrade car shops at Brewster, North White Plains, Poughkeepsie and Grand Central Terminal. Maintenance-of-way facilities will be upgraded at Mott Haven and North White Plains.

$10 million of this program has been provided to complete the funding of the Upper Harlem Electrification Program, and $41.3 million has been allocated for miscellaneous and emergency repair programs.

PROGRAM MANAGEMENT PROCESS

The analytical and planning effort that supported the development of the capital program will continue and will be expanded as the plan is implemented. Given the size and complexity of the program and the number of external factors affecting its implementation, it is necessary to retain a basis for tracking progress and making adjustments as appropriate. Recognizing also that there will be substantial needs unmet at the completion of this five-year plan,the program management process will provide the basis for planning additional phases of what should be a continual renewal program.

There are three key elements in the program management process. First is the capital program tracking system, which will be the primary input to the tracking committee established in the Transportation Systems Assistance & Financing Act. The tracking system will identify the myriad of projects being undertaken by the various operating agencies under the capital plan, reporting on their physical progress and budget performance. As an MTA-wide system, it will be integrated with the particular tracking systems in use in the particular agencies so as to assure compatibility. It will identify problems in meeting construction milestones at an early enough time to take corrective action, and will monitor financial performance as the basis for allocating funds from various sources, particularly those involving bonds which must be marketed on a schedule. MTA staff is now reviewing comparable tracking systems in place for similar complex development efforts.

Second, the MTA will initiate a system of annual capital budgets for the various agencies involved in the revitalization program. This process will permit the annual review of the capital program status, the identification of projects to be initiated in the coming year, and any adjustments required to the five year program to meet such problems as cost overruns or funding source shortfalls. This annual budget will afford the MTA Board the opportunity to

retain some flexibility in dealing with unforeseen conditions and would be the basis for submission of amendments or modifications to the Capital Program Review Board and other funding entities.

Third, the MTA is in the process of developing a basis for regular reporting of system activity and progress through the use of performance indicators. This system ties directly to the call for service and operational standards in connection with the capital program. It is our intention to use the performance measurement system in conjunction with the capital and operating budgets as a basis for allocating resources so that results can be measured. Development of this system is being supported through an UMTA Technical Studies grant, with the first formal reports expected to be available November 1981. The various measures identified as standards in this capital plan will be tracked through the system, along with other indicators more directly oriented to operational and financial factors. In total, the performance measurement system is intended to provide various levels of MTA management, culminating with the Board of Directors, a comprehensive status report on MTA operations and the progress that is being made in meeting management goals and objectives.

SUBMISSION FOR

MTA CAPITAL PROGRAM REVIEW BOARD

CAPITAL PROGRAMS

for

MTA TRANSIT SYSTEMS

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NEW YORK CITY TRANSIT AUTHORITY
(including MaBSTOA)

and

STATEN ISLAND RAPID TRANSIT OPERATING AUTHORITY

 September 25, 1981

CAPITAL POLICY OBJECTIVES - GENERAL

MTA TRANSIT SYSTEMS

The magnitude of capital requirements for the existing system is extraordinary. As articulated in the Capital Revitalization Report of 1980, the cost to accomplish a complete rehabilitation over a ten year period would be over $20 billion dollars. In addition, the completion of the new routes program underway in Queens would require an additional $3 billion dollars.

It is unlikely the Authority can obtain all of these funds during the 1980s. Instead, priorities have to be established for the use of the funds which will be made available. This section recommends a capital project program for calendar years 1982-1986.

In order to accomplish this, a comprehensive capital planning process evolved into four primary goals.

- Reestablish, then maintain, reliable operations on the existing subways and buses. This includes a rational replacement cycle for trains and buses, instead of operating overaged and unreliable equipment as we do now. It includes the rehabilitation of existing passenger vehicles such as remedying defective subway car doors. It also includes improved subway car and bus shops in order to provide the facilities necessary to properly maintain the subway trains and buses.

- Ensure long term survival of the existing transit system and its safe, reliable operation at reasonable cost. Past trends of allowing the existing system to deteriorate must be reversed. We have to make available the funds necessary to establish and then properly maintain the system's infrastructure. Otherwise, one of the City's most important assets will continue to deteriorate.

- Other improvements to the existing system. Such improvements include a more reliable operation and a more commodious environment for the passenger. However, it must be realized these improvements

can be advanced only after the more basic needs to reestablish operations and ensure long term survival are satisfied.

- Advance "new routes" projects now underway: To the extent that a viable interim operation can be accomplished, existing programs should be brought to an orderly conclusion.

With respect to those segments of the projects which involve the improvement of facilities generally available to the public, every reasonable effort will be made to plan and design such elements with consideration to the special needs of elderly and physically handicapped persons.

In past years, the Transit Authority's programming of capital improvements was severely constrained by the limited amount of capital funds being made available. The revitalization program initiated by the Chairman offers the Authority the opportunity to program its capital improvements in a comprehensive manner as opposed to the incremental method used in prior years. For example, in modernizing a bus depot, the Authority would program the replacement of a roof in one year, renew the boilers in a second year and replace the bus washers in a third year, replace the fuel tanks in a fourth year, etc. With the development of adequate funds over a five year period, the Authority will now coordinate all proposed improvements on various Transit Authority and operating rapid transit lines in a comprehensive manner by doing all proposed work required to bring the facility up to a state of good repair. In this manner the Authority should achieve the benefits not only of a lower overall cost but also an acceleration of the process of restoring the physical plant.

A summary and a detailed breakdown of more specific policy objectives in the context of these goals (as well as the costs involved), are shown on the following pages.

The Transportation System Assistance and Financing Act of 1981 requires the identification of specific capital elements. The Act provides for two types of capital elements; one with a specified maximum dollar amount proposed to be expended - which we have designated an A element, and one with a particularly described capital project within one or more categories for which no maximum expenditure is proposed, but for which an estimate of expected cost is provided - which we have designated a B element. The legislation also makes various references to categories.

The specific identification of the elements, their classification - A or B - the description of the work to be accomplished and an estimate of the annual level of commitment is contained on

the following pages. The elements are stated as subsets of their appropriate category. Where there is only one element in a category, they both carry the same designation. However, where there is more than one element in a category each element carries a specific identifier or reference number.

The following coding structure has been developed to specifically identify categories and elements by Agency:

T = NYCTA/MaBSTOA Project
S = Staten Island Rapid Transit Operating Authority Project
L = Long Island Rail Road Project
M = Metro-North Project

Thus, Line Equipment T-6, a category, has only one element. As a result, that element is also designated T-6. Line Structures, category T-7, has two elements. They are identified as T-7a and T-7b. The elements for the NYCTA/MaBSTOA are detailed on pages II A 3.12 through II A 3.33. The elements for SIRTOA are detailed on pages II A 4.5 through II A 4.11.

The capital program elements to be advanced by the MTA as "The 5 Year Program 1982-1986," as authorized by the Transportation System Assistance and Financing Act of 1981, for NYCTA/MaBSTOA and SIRTOA are as follows:

ELEMENTS	5 YEAR COMMITMENT (in millions of dollars)		
	NYCTA/MaBSTOA		
	RAPID	SURFACE	SIRTOA
CLASS A ELEMENTS			
ROLLING STOCK & BUSES			
Cars, New			
IRT	1,377	-	-
IND/BMT	372	-	-
Cars, Rebuilt/Rehab.			
(CORE)	329	-	-
Rehabilitated Cars	42	-	-
Buses	-	312	-
PASSENGER STATIONS			
Station Modernization			
Stations over $15M	-	-	-
Stations under $15M	227	-	-
Component Rehabilitation	82	-	5.8
TRACK			
Track and Contact Rail Rehab.	276	-	2.3
Noise Reduction	89	-	-
LINE EQUIPMENT	97	-	3
LINE STRUCTURES			
Water Conditions, Platforms, Other	58	-	-
Elevated/on Grade Rehab.	141	-	-
SIGNALS AND COMMUNICATIONS			
Signal System Modernization			
"Zone Contracts"	327	-	-
"Non-Zone Contracts"	112	-	-
Communication Systems	61	-	-
POWER EQUIPMENT, EMERGENCY POWER EQUIPMENT & SUB-STATIONS			
Substation Modernization (IRT/BMT)	260	-	11
Substation Re-equipping (IND)	41	-	-

CLASS A ELEMENTS (continued)	5 YEAR COMMITMENT (in millions of dollars) NYCTA/MaBSTOA RAPID	SURFACE	SIRTOA
SHOPS, YARDS, MAINTENANCE FACILITIES, DEPOTS & TERMINALS			
Shops			
Major Mod./Rehab over $35	179	-	-
Other Mod./Rehab and Equip	253	-	0.6
Yards			
Major Rehab. over $20M	104	-	-
Other Rehab. under $20M	113	-	-
Equipment & Yard & Expansion	133	-	-
Depots			
Rehab. and Equip.	-	83	-
New over $25M	-	193	-
New under $25M	-	32	-
SERVICE VEHICLES	53	-	-
SECURITY SYSTEMS	21	-	.4
UNSPECIFIED, MISC. AND EMERGENCY			
Management Information Systems	20*	-	-
Miscellaneous	39*		
Emergency and Contingency	180*	-	1.9
SUB TOTAL CLASS A	$4,986	$620	$25
CLASS B ELEMENT UNSPECIFIED MISC. AND EMERGENCY			
Extensions (New Routes)	$ 180	-	-
SUB TOTAL CLASS B	$ 180	$ -	$ -
TOTAL	$5,166	$620	$25

*Available to NYCTA/Rapid and Surface and to MaBSTOA.

SECTION II A 2

MTA TRANSIT SYSTEMS

PERFORMANCE MEASUREMENT

September 25, 1981

PERFORMANCE MEASUREMENT

MTA TRANSIT SYSTEM

The MTA's Five Year Capital Program 1982-1986 was developed from the Revitalization Report of 1980. The prime objective of the Revitalization Report was to identify, in relatively specific terms, the work that must be accomplished if the accelerating deterioration of the MTA transportation facilities is to be halted and if we are to be able to restore the system to a state of good repair. A failure to accomplish those objectives will surely lead first to increased passenger discomfort, then further deterioration of the system, increased unreliability, and finally an absence of proper levels of safety. Any safety risks will result in gradually shutting the system down, for we will not operate an unsafe system.

It is our belief that this Five Year Capital Program makes a significant start in the direction of revitalization of the system. We would hope to complete most of those tasks during a second Five Year Program.

The true measure of the success of this program is in the increased level of service experienced by the public. In more specific terms the measure of the program is the difference between the level of service that would be produced if this program were not advanced - and the general deterioration were allowed to continue - and the level of service that will be provided.

The measures of accomplishment that follow are comparisons between the present levels and the levels we believe the program will achieve. The comparison is "limited" in this way because a comparison with a forecast of what service would be like, absent these capital improvements, is too subjective and/or theoretical to be meaningful and is dependent on many factors beyond the scope of this program.

The above is not meant to suggest that more specific measures are not necessary. They are necessary and we continue to work towards developing both the standards of measurement and the data required to use them. Just as we have made great strides, over the past several years, in the process of setting priorities for capital projects, we believe we can make major strides in the more specific measurement of the interrelationships among the components of our transit systems. To have deferred the initiation of this program until the precise measures of specific interrelationships among elements on the performance of the total system were quantified in detail would be foolhardy: much of the system is nearing collapse and secondly, the cost of the program, at today's rates of inflation, is increasing by $60 million each month it is delayed.

The following is a series of measurements of present and projected performance of the system as a whole and, as appropriate, selected components of the system. Each of the performance measurement factors identifies the factor being measured, provides the present and anticipated levels and identifies the capital programs that contribute to the improvement.

The basic, most all encompassing measure of NYCTA Rapid Transit performance is its "Key Location Through Put."

Key Location Through Put is the percentage of trains actually operating past key points during the morning and evening rush periods compared to what is scheduled. The key point locations are generally the entrances to the Central Business District. The NYCTA goal for "Through Put" is 98%.

Attaining this goal requires significant reductions in the number of trains that are abandoned daily on the system. There are two forms of abandonments: terminal abandonments and enroute abandonments.

Terminal abandonments are the number of scheduled trains, per day which are not put into service because a sufficient number of trains are not available when they are needed.

Enroute abandonments are the number of trains, per day, taken out of service for any reason after they leave their originating terminal.

SUMMARY OF INCREASED "THROUGH PUT" PERFORMANCE
(PEAK AM/PM PERIOD)

	Year	Trains Per Day	% of Schedule	% Improvement
Through put, key locations	1981	1215	89	-
	1987	1332	98	10%
Terminal abandonments	1981	190	-	-
	1987	30	-	84%
Enroute abandonments	1981	140	-	-
	1987	65	-	54%

General Reliability: These goals can only be attained by having a reliable fleet of passenger car equipment which will significantly reduce the number of car failure delays experienced on the system. Car related delays are currently running at about 40,000 per year. This means there is a failure every 6700 miles of operation. This mileage between car failure, called Mean Distance Between Failure (MDBF), is

used by the Transit Authority to measure car equipment reliability and is a major indicator of overall train service performance. The Transit Authority's objective for MDBF is an increase from 6700 to 15,000 miles by 1987. This can only be accomplished by advancing several programs utilizing both operating and capital funds.

One such capital program funded prior to the 5 Year Program is the replacement of R46 trucks. When completed in 1984, over 100 additional R-46 cars will be available for service and the MDBF for the R-46 fleet will be over 13,000 miles.

Existing shop space and time will be freed from the burden of periodic inspections of R46 trucks and some of the older cars presently serviced as a result of the unavailability of the R46 can be retired.

Programs included in the 5 Year Plan are the purchase of 1376 new cars; the reconstruction of existing cars and the modernization of all car maintenance facilities. These new cars will have an MDBF of 30,000 miles; they will replace more than 20% of the existing fleet which have an MDBF of 4700 miles. The 300 R44 cars with a present MDBF of 4000 miles will be reconstructed by 1984; this will improve their MDBF to over 12,000 miles. In addition, the program to overhaul and replace the car door operator system on all remaining cars will be completed by 1986. Approximately 10,000 of the 30,000 delays last year were attributable to defective car door operations. The new door operator system will improve door performance by at least 50% to a standard of 4,500 delays per year.

DELAYS CAUSED BY DEFECTIVE CAR DOORS

Year	No. Delays Per Year
1981	10,000
1986	4,500

The modernization of car maintenance facilities is another essential element in reestablishing reliable train service. This program will provide effective and more productive maintenance centers which, in turn, will result in more reliable car equipment. However, further detailed engineering and development is required before the amounts of reduced delays and increased MDBF resulting from this program can be quantified.

Another essential element is a continuing comprehensive overhaul program. By 1986, 3700 cars will be given a programmed overhaul in the barns. It is expected the MDBF of any

individual car can be increased by 10% with such overhauls. Also by 1986, 2300 cars will go through a major overhaul in the shops which should result in a 25% increase in their MDBF.

The cumulative effect of all these programs will enable the Transit Authority to accomplish its objectives for MDBF and will be a major step in attaining its goals toward reestablishing reliable train operations.

The major area where the Transit Authority can improve the efficiency of train service is in the number of "spare" cars. "Spare" cars are the number of cars in the fleet over and above the number of cars required to provide scheduled peak period service. This number of cars is needed for performing maintenance and overhaul activities and to account for operating logistics.

The Transit Authority has 6,311 cars in the fleet of which 1,313 cars are "spares". In other words, to assure enough cars for rush hour service a spare factor of 20.8% is needed. Such a spare factor is inefficient but necessary given the poor condition of the existing fleet. The Transit Authority's long term spare factor goal is 15%, a ratio which will permit improved efficiency, maintenance and operation.

Improving fleet reliability by advancing the above fleet modernization programs will enable the Transit Authority to reduce the spare factor to less than 17% by 1987. This will reduce the size of the fleet by 348 cars without any reductions in service levels.

While the major impact on system improvements will be provided from the new car program and from car-related investments, the $1.4 Billion planned investment in supporting systems--track, signals, communications, equipment and power--will permit the car investment to produce optimum results. Without the parallel expenditures in these infrastructure areas, the car program benefits would be offset by deterioration and decay. With this investment to stabilize the physical condition of the system as a whole, the full increment of improvement brought about by new cars and car rehabilitation will be realized, with perhaps, some additional degree of reliability in these infrastructure elements. Indeed the above mentioned Through Put improvements may not be achieved and may still further decline if the infrastructure improvements are not made.

The modernization of car maintenance facilities will also result in more efficient train operations by improving the productivity of its employees. The Transit Authority hopes to obtain a substantial increase in productivity but the actual increase to be realized cannot be determined until detailed design, industrial engineering and program development is completed.

Infrastructure Rehabilitation

A major goal of the Five Year Program is to begin the process of restoring the system to a state of good repair. With regards to Line Equipment and Line Structure these two categories will be replacing in kind, components that were installed when the system originally opened. The purpose of infrastructure rehabilitation is to replace deteriorated system components in order to insure long term safety and reliability irrespective of any cost savings and are not quantified.

With regards to the Track and Signal rehabilitation categories the Authority anticipates that for those portions of the system that are modernized the availability will be increased to 98%, reducing by 50%, the outage due to signal and track related problems.

Air-Conditioning: One measure of car fleet comfort is the percentage of cars air-conditioned. By the end of 1982 with the completion of the current air conditioning retrofit program underway, 3,022 cars will have been air conditioned.

The 5 Year Program includes the purchase of 1376 air conditioned cars and the start of a retrofit program retrofitting ten existing cars with air conditioning. These programs along with a reduced spare factor will result in a fleet which is 74% air conditioned by 1988.

The air-conditioning systems on existing cars are performing at an 88% level; that is, an average of 88 out of every 100 air-conditioning units are in working condition at any point. The Transit Authority's goal is 95% for this program. The eventual goal is 98%.

SUMMARY OF AIR CONDITIONING PROGRAM

Year	Cars	% of Fleet	Performance Level	% of Fleet
1981	3022	48%	2660	88%
1987	4400	74%	4170	95%

PASSENGER STATIONS: The program will provide a more attractive and convenient environment at passenger stations by the modernization of existing stations.

Only 10 of the existing 465 stations on the system have ever been modernized. Only immediately needed partial station improvements have been made on the remaining 455 stations. This has led to a general decline in the appearance and functional aspects of the stations.

An objective of the 5 Year Program is to complete the modernization of an additional 50 stations by 1988 including the most used stations in each of the boroughs of Manhattan, Brooklyn, Queens and the Bronx. Although this represents only 11% of the stations on the system, almost 25% of all passengers will use these stations. In fact, the use of turnstile registrations has the effect of understating substantially the percentage of riders who will benefit. Our goal is to eventually modernize all stations so that all passengers will enjoy the pleasant surroundings afforded by that conversion.

SUMMARY OF STATION MODERNIZATION PROGRAM

Year	No. of Stations	% Increase	Total Daily Turnstile Count	% Increase
1981	9	-	180,000	-
1988	59	556%	1,040,000	461%

NYCTA Surface/MaBSTOA

The Surface improvements are directed towards new and rehabilitated depots and the acquisition of new buses. The benefits of the program are as follows:

	Year	TA Runs	%	OA Runs	%
Trips Scheduled	1981	11,713	-	9,290	-
Trips Cancelled at origin	1981	152	1.2	162	1.7
	1984	61	.5	65	.7
	1986	11	.1	11	.1
Trips Cancelled on Route	1981	79	.7	178	1.9
	1984	55	.5	126	1.3
	1986	37	.3	84	.9

(in thousands of trips, 1984 and 1986 are estimates)

The projections indicated above are anticipated primarily as a result of the reliable, continuous influx of new buses into the system as presently planned. Further improvements are anticipated as the maintenance facilities of the Authority undergo major improvement.

SIRTOA

The portion of the SIRTOA program that will be most noticed by the passengers are the station improvement projects.

Under the Station Improvement Program, eleven wayside stations will be lengthened to allow the berthing of a four-car train consist. In so doing, dwell time at these stations will be significantly reduced. Also, two stations, constructed of timber, are in a deteriorated condition and must be replaced.

The car fleet, consisting of 52 R-44 cars, is relatively new, and is well maintained, and in generally good condition.

SECTION II A 3

NEW YORK CITY TRANSIT AUTHORITY

Specific Project Objectives, Program Goals and Plan

September 25, 1981

NEW YORK CITY TRANSIT AUTHORITY

SPECIFIC PROJECT OBJECTIVES AND PROGRAM GOALS

REESTABLISH RELIABLE OPERATIONS

Cars, New and Rebuilt/Rehabilitated: This program is designed to provide safe, reliable and commodious service through fleet modernization. It has been subdivided into two elements; New Cars and Rebuilt/Rehabilitated Cars.

Cars, New is a program to purchase 1,376 new rapid transit cars. These cars will permit the retirement of 1,724 (28 percent of the fleet) overaged cars and/or unreliable passenger cars.

The key program objective is to order 1,150 IRT cars and 226 BMT/IND cars by 1984. Based on manufacturers' and suppliers' capacities, we expect delivery of 130 cars in 1983, 300 cars in 1984, 360 cars in 1985 and in 1986, and 226 cars in 1987.

Cars, Rebuilt/Rehabilitated is a continuing program to rehabilitate and enhance existing subway cars, and replace defective car door mechanisms on over 2,331 cars. Advancing these programs and other such programs as the need arises will be a major step in reestablishing a reliable subway operation.

Some improvements in reliability from these programs will be realized almost immediately. Reliability will then slowly increase and by the end of 1983, substantial service improvements will be realized.

Currently, the average annual car equipment Mean Distance Between Failures (MDBF) for the car fleet of over 6,300 vehicles is 6,700 miles. The average age of the subway car fleet, which includes 1,310 spare cars (21%), is 18 years. There are 3,017 cars, 48% of the car fleet, which are air-conditioned or currently being retrofitted. Phase I of a car door modernization program is also underway with 1,194 cars to be retrofitted with modernization kits and 1,100 with new door operators.

The operating objectives are to increase the MDBF to 15,000 miles by 1987. Further, the spare ratio will be reduced from 21% to 17%, resulting in a 5,963 car fleet by 1987.

The second phase of the car door modernization program will retrofit an additional 2,331 cars by 1987.

At the present time 2,797 cars (44%) of the 6,311 cars are air-conditioned. An additional 225 cars will be air-conditioned prior

to the 5 Year Program increasing the number air-conditioned to 3,022 (48%).

A program in the 5 Year Plan to retrofit ten cars of the IND/BMT fleet with air-conditioning will be completed by 1986. This, along with the purchase of new cars, will result in 74% of the car fleet being air-conditioned by 1988.

Complementing the capital improvements funded by the 5 Year Program will be continuing comprehensive overhaul programs. A barn overhaul program ("D" overhaul at 180,000 miles) will overhaul 3,700 cars by 1986. A shop overhaul program ("E" overhaul at 360,000 miles or "F" overhaul at 720,000 or "G" overhaul) will complete 2,300 cars by 1986.

Concurrently, selected car reconstruction projects will be advanced to remedy subsystem defects on existing cars by 1985.

Buses: This program is designed to provide safe, reliable and commodious service through fleet modernization and to reduce the fleet size to 4,000 buses. In addition, it is planned to achieve a 12 year bus replacement cycle by 1990. At the present time the fleet consists of 4,560 buses. Of these, approximately 1,178 buses are over 12 years of age and the number of spares is 1,211 or 26% of the fleet.

The 5 Year Program will purchase 1,605 new buses and will reduce the spare ratio from 26% to 16%. Further, the number of buses over 12 years of age will be reduced to 573. In addition, up to 50% of the fleet will be accessible to the elderly and handicapped.

On the average, 325 buses per year for the next four years and smaller purchases through 1990 are needed in order to attain and then maintain the bus industry and nationwide standard of a 12 year replacement cycle for the existing bus fleet.

This is a continuation of an existing "ongoing" program. This program will be completed by the end of the 1980s, at which time every bus in the fleet will be less than 12 years old.

The measure of fleet reliability is the distance between road calls and is currently 681 miles for TA and 348 miles for OA. The goal of the five year plan bus purchase program will be to increase the distances to 1,000 miles and 500 miles respectively.

Shops: The program provides for efficient and effective maintenance centers within an environment conducive to good working conditions and employee morale.

Most Car Maintenance shops and barns are in a deteriorated condition, have inefficient layouts, and provide inadequate space to support effective maintenance practices. Most Maintenance of Way shops are also in a deteriorated condition and do not provide adequate space.

The 5 Year Program will advance a comprehensive program to completely modernize all Car Maintenance shops by 1989, that is, the two main repair shops at Coney Island and 207th Street, and the 13 barns located throughout the system.

The program will provide the basic Car Maintenance plant facility and realize a 7% anticipated increase in Car Maintenance productivity by 1990 as a result of shop modernization and other related programs. The amount of annual car miles per Car Maintenance employee will be used to measure productivity. A 7% productivity improvement will require an increase in annual car miles per employee from 40,000 to 43,000 by 1990.

The program will replace, modernize and/or rehabilitate several Maintenance of Way shops and employee facilities under the 5 Year Program.

Also included as part of the program are Power Distribution and Equipment Shops: Maintenance of special equipment, i.e.: tampers, payloaders, cranes, railwelder, etc.

The following work will also be progressed:

- Structure: Foundry steel fabrication, machine shop, burn and weld.

- Line Equipment: Ventilation and drainage pump overhaul.

- Linden Shop: Track fabrication.

<u>Depots</u>: It is proposed to provide efficient and effective bus storage and maintenance facilities in an environment conducive to good employee morale.

At the present time the Authority and MaBSTOA operates twenty-two (22) facilities with an average age of 50 years; the oldest being 95 years of age. Facilities have deteriorated, and have inefficient layouts not conducive to effective maintenance. Depot equipment is old and unreliable. The bus radio system is over 14 years old. Replacement parts are difficult or very costly to obtain.

The 5 Year Program will replace five depots with new facilities and construct new central maintenance, central stores, truck maintenance and administrative facilities.

The program provides for the rehabilitation of ten depots including mechanical and motorized equipment. Also included is the reconstruction of the radio system and purchase of 3,900 new bus radios.

ENSURE LONG TERM SURVIVAL AND A SAFE, RELIABLE SYSTEM

Track: It is planned to provide safe and reliable train operations through track rehabilitation.

Many sections of the track roadbed are in a deteriorated condition and beyond normal maintenance repair. Approximately 900 switches on the mainline are still the original, now obsolete knuckle and lap type switches. Most running rail is not welded nor supported on rubber rail seats.

A continuing program has been developed which will replace deteriorated track roadbed as dictated by field conditions. The 5 Year Program provides for the replacement of approximately 50 miles of track.

A multi-year program to replace obsolete knuckle and lap type switches will be advanced. The 5 Year Program provides for the replacement of 140 switches (16%).

A 20 year program to replace existing rail with welded rail on rubber rail seats will be programmed. The 5 Year Program provides for the replacement of 100 miles which, when completed, will result in welded rail for approximately 30% of the system.

A program to install rubber rail seats under new bolted rail in the noisiest sections of elevated lines will be initiated. The 5 Year Program provides for approximately 9 miles of rubber rail seats.

The program (20 miles) replacing 75 lb. mainline third rail with 150 lb. third rail will be completed within the 5 Year Program.

Line Equipment: Line equipment consists of the various types of equipment and facilities along the right of way such as emergency ventilation fans, tunnel lighting, pumps, power distribution networks, etc. Most line equipment is original equipment and has never been modernized or rehabilitated. This includes the ventilation equipment (fans), tunnel lighting along 448 miles of underground track, over 800 pumps at approximately 250 locations and power distribution cables and facilities throughout the system.

It is proposed to advance a multi-year program to replace tunnel lighting. Five locations, approximately 30 track miles, will be replaced under the 5 Year Program.

A multi-year program to replace pumping facilities providing new and in some cases larger pumps at 23 locations is planned. At the completion of the 5 Year Program approximately 20% of the pumping locations will have been modernized.

A multi-year program to replace emergency ventilation facilities will be progressed. 23 existing ventilation facilities will be upgraded and two new fan plants will be installed. At the completion of this work one-third of the facilities will be modernized.

Power distribution will be rehabilitated at three locations by 1987.

Line Structures: It is proposed to rehabilitate mainline structures which are beyond normal maintenance repair.

Subway structures have been undermined at 20+ locations due to ground water infiltration. Remedies at half of these locations have been or will be completed prior to the 5 Year Program.

The Authority will replace the remaining wooden platforms by 1984 and begin a multi-year program to replace wooden mezzanines. Five stations with wooden mezzanines will be replaced in the 5 Year Program.

All wooden platforms at elevated line stations will be replaced prior to the 5 Year Program except at three stations on the Jamacia Line. Ninety-nine (99) stations throughout the system still have wooden mezzanines.

It is proposed to remedy remaining existing water conditions under the 5 Year Program.

Certain elevated structures throughout the system have structural elements that need rehabilitation which includes: thru-span girder webs, flange angles, gusset plates and column supports.

Additionally, the Authority will advance a comprehensive rehabilitation program for various structures throughout the system.

As part of the program, water lines will be replaced to ensure adequate and reliable water supply and fire protection to all facilities. Water/discharge lines at two locations will be replaced under the 5 Year Program.

Signals and Communications: It is proposed to maintain safe and improve reliable train operation through signal system rehabilitation and modern communication systems.

Most of the 238 miles of IRT signal system except 20+ miles in Brooklyn has been rehabilitated since World War II; several sections were not completely modernized. Most of the 469 miles of BMT/IND signal system is between 40 and 65 years old and has never been rehabilitated.

The solid state signal code system is unreliable and requires excessive maintenance and most of the telephone cables throughout the system are in deteriorated condition, as well as the train and police radio system antenna cable. The cable in the under-river tubes is deteriorating due to moisture conditions.

It is proposed to replace the remaining 20+ miles of IRT signals in Brooklyn and almost 400 miles of BMT/IND signals by the year 2000. Ninety-four (94) miles of signal system will be replaced under the 5 Year Program.

The Authority will replace the entire solid state code system for the signal system with a direct wire system under the 5 Year Program.

The Program will advance a multi-year program to replace deteriorated telephone cable and add new cable to accomodate future needs. It is proposed to replace and modernize 66 miles of cable under the 5 Year Program.

The Program will replace all train and police radio antenna cable in the 12 under-river tubes with radiax cable by 1987.

The Authority will install a new Maintenance of Way radio communication system by 1988.

<u>Power, Substations, Etc.</u>: The program will provide a reliable power system operation by providing continuous power at minimal cost.

Prior to the 5 Year Program, less than 50% of power system will be modernized.

Twenty-eight (28) substations, constructed prior to 1927, are still manually operated and have 25 Hertz equipment. Four of these substations will be phased out prior to 5 Year Program.

More than 50% of the system is made up of inefficient and overaged mercury arc and rotary converter substations.

The 5 Year Program will modernize approximately 30% of the system and eliminate 19 manually operated substations. This entails the

construction and equipping of 36 IRT/BMT (26 new sites, 10 existing sites) substations and equipping 25 IND substations.

By 1988, a total annual savings of $8.5M (present day cost) and a 150 reduction in manpower quota will be realized. At the completion of the 5 Year Program, more than 20% of the power system will still need to be modernized.

Yards: The Authority has never had the capital resources necessary to advance a comprehensive program for yard rehabilitation. Vandals have easy access to mainline car storage areas and frequent residential complaints concerning noise caused by cars stored on mainline structures are received. Additionally, car storage on mainline tracks limits operational flexibility.

The 5 Year Program will initiate a program to completely rehabilitate 22 yards (track, contact rail, power, signals, etc.) by the year 2000. Six yards will be rehabilitated under the 5 Year Program. Also included are security improvements in all yards by 1988. This program includes fencing, razor ribbon, improved lighting and possible some sophisticated security systems.

The Authority plans to initiate a program to expand seven yards; three of which are in the 5 Year Program. These three expansions (Stillwell, Coney Island and Jamaica) will eliminate the need to store trains on Queens Boulevard, Brighton, West End and Culver Lines. This program will improve operations by reducing vandalism, expecially when combined with the yard security program, and improve yard flexibility. The Authority also will rehabilitate individual yard components when such work cannot be delayed until such time as a complete rehabilitation is scheduled for the location. The 5 Year Program includes replacing contact rail in five yards, power distribution facilities in one yard, hydrant system in one yard and lighting in three yards.

Service Vehicles: In order to support system maintenance and capital rehabilitation an increased number of reliable work trains and automotive trucks must be provided.

On the average, 45 work trains operate daily: 30 for maintenance work and 15 for capital rehabilitation. The schedule calls for 30 trains/ night and 15 trains/day. Many work train units are overaged or inefficient.

Automotive trucks are replaced in accordance with criteria that includes years in service such as light trucks when they are five years old; medium and heavy trucks when they are ten years old. This also occurs when mileage is more than 75,000 miles or when the cost of repairs becomes excessive.

The total truck fleet now is 340 vehicles. 122 vehicles are currently overaged or overmileage.

The Authority will continue to replace automotive trucks in accordance with present criteria. This requires the purchase of approximately 150 trucks during the 5 Year Program (including Surface).

OTHER IMPROVEMENTS

Passenger Stations: The program will provide stations with a commodious environment, safe and reliable equipment and structures, and improvements for the elderly and visually handicapped.

Most of the system's 465 stations have never been modernized, although many station improvements are underway or have been recently completed. For instance, 100 of the 113 escalators on the system are in good working condition or will have been rehabilitated or replaced prior to the 5 Year Program. Three of the 23 elevators are overaged and unreliable and are included in the 5 Year Program. Platform roofs and canopies will have been replaced at 55 of 192 elevated stations (29%) prior to start of the 5 Year Program. All subway stations except 13 will have fluorescent lighting prior to the 5 Year Program; 55 of 192 elevated stations (29%) will have fluorescent lighting, and 244 stations (52%) will have public address systems at the start of the 5 Year Program.

The 5 Year Program will modernize approximately 50 stations, replace all 13 unreliable escalators and three elevators at six stations; replace 32 platform roofs and canopies (17%) including installation of new lighting and signage; replace 1,028 turnstiles at 215 stations of the approximately 2,600 turnstiles on the system; complete the installation of fluorescent lighting at all subway stations and do 22 elevated stations; complete (71 stations) the installation of abrasive warning strips on all stations; complete (145 stations) the station signage program; and install public address system at 30 stations. 191 stations (41%) will still not have public address systems when the 5 Year Program is completed.

Security Systems: This program will provide "Off-Hour Waiting Areas" to reduce crime incidents in rapid transit stations by congregating passengers in designated station areas.

A total of one hundred thirty-seven stations (30%) will have been provided with Waiting Areas (54 stations) and Waiting Areas with Annunciators (83 stations) prior to the start of the 5 Year Program.

CCTV at Waiting Areas is being evaluated and the results will be available in early 1983. A determination will be made then, whether to proceed with the installation of CCTV in Waiting Areas on a system wide basis.

The 5 Year Program will complete Waiting Areas (51 stations) and Waiting Areas with Annunciators (277 stations) at the remaining 328 stations by 1985.

Emergency/Miscellaneous: The 5 Year Program will provide for improving the flow of information in a number of areas within the Transit Authority. Also included in this category are funds to complete projects not identifiable in the other 15 categories.

The Management Information System (MIS) in many areas is presently maintained manually. The Management Information System (MIS) will be computerized in the following areas:

1. Ridership/Scheduling/Work Assignment.

2. Planning, Operating and Financial Control.

3. Material/Maintenance Management.

4. Data Base Management.

5. Word Processing.

The program will also provide for the completion of:

1. Rapid Transit employee facilities which are not located in yards.

2. Police district offices located at 161st Street and Hoyt Schermerhorn will be renovated and 12 driver training simulators will be purchased.

3. Improvements to Rapid Transit Operations such as new cross-overs at East 180th Street and Brighton Beach, and a train dispatch system for the A and B Divisions will be made. The train dispatch system consists of control turrets on each of the radio consoles in the Jay Street Command Center to be linked to all towers, dispatchers and yardmaster locations in the A and B Divisions.

4. Improvements to maintenance facilities and equipment which are not located in yards will be added and new facilities such as Bridge Street in Brooklyn will be

constructed. Existing facilities such as Carroll Street, Bergen Street and Jay Street will receive various improvements, such as heating and boiler replacement and roof replacement.

NEW ROUTES

It is proposed to provide service on the East 63rd Street Line (Route 131-A) and on the Southeast Queens Line (Route 131-D/133) which are presently under construction.

The 5 Year Program will place into revenue service three new stations on the East 63rd Street Line: Lexington Avenue, Roosevelt Island and 21st Street Stations. Extension of service will be provided from the Seventh Avenue BMT and the Sixth Avenue IND Lines. The program will also place into revenue service three new stations on the Southeast Queens Line: Van Wyck, Sutphin Boulevard and Parsons Boulevard Stations. Extension of service will be provided to the Queens Boulevard Line, IND, and to the Jamaica Elevated Line, BMT.

The Emergency/Contingency element will be used to provide such funds as are authorized to complete the analysis of the New Routes Alternatives and, as appropriate, initiate preliminary engineering of preferred alternative(s).

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Cars, New

CATEGORY NO.: T-1

GOAL: Maintain a safe reliable and commodious car fleet.

5 YEAR COST: $1,749M

POLICY OBJECTIVE: Increase the reliability of the fleet and by 1990, to reduce the spare ratio to 15+%

ELEMENT DESCRIPTION: The New York City Transit Authority operates a fleet of 6,311 transit cars made up of 2,636 IRT cars and 3,675 IND/BMT cars. In order to remove from active service those older cars with a proven record of unreliable performance, the Authority proposes to advance the purchase of 1,376 new air-conditioned cars. 1,150 new cars will replace 1,233 R-12 through R-22 IRT cars and 226 new cars will replace 491 R-10 and R-16 IND/BMT cars. The design of the new cars will stress improved performance, safety, passenger comfort and noise reduction.

The advancement of this purchase program will increase the reliability of the fleet by increasing the mean distance between failures from 6,700 miles to 15,000 miles by 1987. As this phase of car replacement program is completed in 1987, the spare ratio of the fleet will be reduced from 21% to 17%.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-1a	Purchase IRT Cars (CM09).	A	1,377*	-	-	-	-	1,377	
T-1b	Purchase BMT/IND Cars (CM09).	A	-	-	372	-	-	372	

* Includes $345M for 325 IRT car carry over from 1981.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Cars, Rebuilt/Rehabilitation — CATEGORY NO.: T-2

GOAL: Rehabilitation of existing Rapid Transit Cars — 5 YEAR COST: $371M

POLICY OBJECTIVE: Increase reliability of the existing rapid transit fleet.

ELEMENT DESCRIPTION: A comprehensive rehabilitation program addressing recurring car problems will be advanced.

Under the CORE (Car Overhaul Rehabilitation and Enhancement) Program, the Authority will reconstruct some of the existing cars in accordance with the current state of proven technology remedying most defects on the existing cars by 1985. Rehabilitative work will include installation of high impact shatter-resistant safety windshields in motormen's cabs, change-over of air brake systems for greater reliability, installation of new lighting and re-flooring for noise abatement.

Existing unreliable and/or defective car door mechanisms will be replaced with a more reliable equipment affecting 2,331 cars by 1987.

The advancement of the car purchase program, and subsequent retirement/replacement of the older non air-conditioned cars, will complete the retrofit program for the IRT fleet. The only non air-conditioned cars in the IRT fleet will be the 39 single unit cars in the R-33 series. By 1988 the air-conditioned fleet will consist of 4,400 cars or 74% of the entire fleet.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-2a	Car rehabilitation and enhancement program (CORE)(CM 11).	A	69	65	65	65	65	329	
T-2b	Modernize Car Door Systems (CM02), Retrofit existing cars with air conditioning (CM06), Purchase and install intercar safety barriers on 75 ft. cars (CM10)	A	10	13	19	-	-	42	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Buses

CATEGORY NO.: T-3

GOAL: Continue a bus purchase program to replace overaged and unreliable buses.

5 YEAR COST: $312M

POLICY OBJECTIVE: Attain, then maintain a twelve year bus replacement cycle for the fleet and reduce the size of the fleet to 4,000± buses.

ELEMENT DESCRIPTION: The Transit Authority presently operates a fleet of 4,560 buses carrying 640,000,000 passengers per year, over 1,000 route miles in all five boroughs. Currently there are approximately 1,178 buses over 12 years of age. During the five year plan, 1,605 buses will be purchased. At the end of this 5 year program only 573 buses will be over 12 years of age. In addition, up to 50% of the bus fleet will be accessible to the elderly and the handicapped.

The measure of fleet reliability is the distance between road calls and is currently 681 miles for TA and 348 miles for OA. The goal of the five year plan bus purchase program will be to increase the distances to 1,000 miles and 500 miles respectively.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-3	Purchase new buses (SF02).	A	54	59	64	66	69	312	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Passenger Stations

CATEGORY NO.: T-4

GOAL: Modernize/Rehabilitate Rapid Transit Stations.

5 YEAR COST: $309M

POLICY OBJECTIVE: Improve the image of the transit system, facilitate passenger flow, eliminate confusion, provide better service and a better environment for the passenger, and ultimately increase system ridership.

ELEMENT DESCRIPTION: A station is one of the most visible physical elements of a rapid transit system with which a passenger comes in contact while using the system. The station environment, next to the car, creates a lasting impression of the system in the mind of the passenger.

There are 465 stations on the NYCTA Rapid Transit System. Only immediately needed partial station improvements were undertaken by the previous capital programs. This had led to a general decline in the appearance and functional aspects of the stations.

The Station Modernization Program is designed to improve the environmental and functional aspects of a rapid transit station by eliminating unattractive elements, increasing visual acuity, enhancing station appearance, augmenting station security areas and easing traffic congestion within a station.

In designing for a station modernization, the entire station will be treated as a unit and a harmony in design will be achieved by coordinating the various elements of a station. The improvements will include: architectural work on walls, ceilings and floors, lighting, public information, structural repairs, amenities, security and passenger circulation. Special efforts, such as signage improvements and installation of abrasive warning strips along the edge of the station platforms, will also be made to assist the elderly and the handicapped.

Under this program 50 rapid transit stations, in the four boroughs of the city in which NYCTA-Rapid operates will be modernized.

In addition to Station Modernization, individual station improvement programs, geared toward rectifying conditions which require immediate attention, will also be undertaken. These individual station improvement programs include: replacing platform roofs and canopies at 32 stations, providing emergency power for station lighting at 23 stations, replacing turnstiles at 215 stations, replacing incandescent lighting with fluorescent lighting at 35 stations, installing abrasive warning strips at 71 stations and providing improved station signage at 145 stations.

The Station Modernization Program and the component rehabilitation Program, when implemented, will provide better service and a better environment for the transit passenger.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Buses

CATEGORY NO.: T-3

GOAL: Continue a bus purchase program to replace overaged and unreliable buses.

5 YEAR COST: $312M

POLICY OBJECTIVE: Attain, then maintain a twelve year bus replacement cycle for the fleet and reduce the size of the fleet to 4,000± buses.

ELEMENT DESCRIPTION: The Transit Authority presently operates a fleet of 4,560 buses carrying 640,000,000 passengers per year, over 1,000 route miles in all five boroughs. Currently there are approximately 1,178 buses over 12 years of age. During the five year plan, 1,605 buses will be purchased. At the end of this 5 year program only 573 buses will be over 12 years of age. In addition, up to 50% of the bus fleet will be accessible to the elderly and the handicapped.

The measure of fleet reliability is the distance between road calls and is currently 681 miles for TA and 348 miles for OA. The goal of the five year plan bus purchase program will be to increase the distances to 1,000 miles and 500 miles respectively.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-3	Purchase new buses (SF02).	A	54	59	64	66	69	312	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Passenger Stations

CATEGORY NO.: T-4

GOAL: Modernize/Rehabilitate Rapid Transit Stations.

5 YEAR COST: $309M

POLICY OBJECTIVE: Improve the image of the transit system, facilitate passenger flow, eliminate confusion, provide better service and a better environment for the passenger, and ultimately increase system ridership.

ELEMENT DESCRIPTION: A station is one of the most visible physical elements of a rapid transit system with which a passenger comes in contact while using the system. The station environment, next to the car, creates a lasting impression of the system in the mind of the passenger.

There are 465 stations on the NYCTA Rapid Transit System. Only immediately needed partial station improvements were undertaken by the previous capital programs. This had led to a general decline in the appearance and functional aspects of the stations.

The Station Modernization Program is designed to improve the environmental and functional aspects of a rapid transit station by eliminating unattractive elements, increasing visual acuity, enhancing station appearance, augmenting station security areas and easing traffic congestion within a station.

In designing for a station modernization, the entire station will be treated as a unit and a harmony in design will be achieved by coordinating the various elements of a station. The improvements will include: architectural work on walls, ceilings and floors, lighting, public information, structural repairs, amenities, security and passenger circulation. Special efforts, such as signage improvements and installation of abrasive warning strips along the edge of the station platforms, will also be made to assist the elderly and the handicapped.

Under this program 50 rapid transit stations, in the four boroughs of the city in which NYCTA-Rapid operates will be modernized.

In addition to Station Modernization, individual station improvement programs, geared toward rectifying conditions which require immediate attention, will also be undertaken. These individual station improvement programs include: replacing platform roofs and canopies at 32 stations, providing emergency power for station lighting at 23 stations, replacing turnstiles at 215 stations, replacing incandescent lighting with fluorescent lighting at 35 stations, installing abrasive warning strips at 71 stations and providing improved station signage at 145 stations.

The Station Modernization Program and the component rehabilitation Program, when implemented, will provide better service and a better environment for the transit passenger.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-4a	Station Modernization Over $15M per Station	A	-	-	-	-	-	-	
T-4b	Station Modernization (ST02). Under $15M per Station	A	45	37	47	49	49	227	
T-4c	Replace overage escalators (MW03), Replace/Rehabilitate elevators (MW05), Replace platform roofs and canopies (MW23), Power for Emergency lighting (MW25), Replace turnstiles (MW34), Replace incandescent station lighting with flourescent (MW36), Install abrasive warning strips (ST05) and Provide improved station signage (ST06).	A	12	22	10	17	21	82	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Track

CATEGORY NO.: T-5

GOAL: Upgrade mainline track, contact rail and switches.

5 YEAR COST: $365M

POLICY OBJECTIVE: Attain and then maintain a rational track replacement cycle and reduce track related noise levels.

ELEMENT DESCRIPTION: Exclusive of yards, there are approximately 450 miles of underground track in the Transit Authority network. Another 260 miles are elevated, in open cut or on embankment. Present trackage consists predominately of bolted steel rails seated on steel tie plates and spiked to wood ties. In order to accomplish the required train movements, there are approximately 2,500 switches. A major component of the track system is the contact rail (third rail) which supplies power to subway cars.

Continuous programs of track, switch and third rail rehabilitation/replacement are vitally necesary to transport system riders in a reliable and safe manner.

Typically, track rehabilitation will include the removal and replacement of running rails, third rails, ties and ballast. It is the current policy of the Authority to replace/rehabilitate existing subway and at grade trackage with welded rails seated on resilient pads whenever possible.

Track switch replacement generally includes the removal of existing knuckle/lap switches, rails, ties and ballast; the replacement of switch machines when required; installation of new area turnouts, rails and ties. Worn third rails will be replaced with new 150 pound rail. On elevated structure (where welded rail cannot be used) new bolted rail on rubber rail seats will be installed.

Noise reduction will be accomplished through the use of welded rail and rubber rail seats in track replacement projects. Additional noise reduction will be achieved through other projects in which new welded rail will be installed and portions of the roadbed will be replaced as necessary, and projects in which new bolted rail will be installed on rubber rail seats seated on new ties.

The objective of the 5 year program will be to accomplish the following:

Track Rehabilitation	50 Miles
Welded Rail	100 Miles
Rubber Rail Seats (Els)	9 Miles
Third Rail	20 Miles
Switches	140

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-5a	Rehabilitate mainline track (MW26), Modernize/replace track switches (MW28) and Replace contact (third) rail (MW11).	A	52	61	61	58	44	276	
T-5b	Weld rail on subway tracks (MW44) and Install rubber rail seats (MW45).	A	14	17	25	15	18	89	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Line Equipment CATEGORY NO.: T-6

GOAL: Attain, then maintain a rational replacement cycle for line equipment

5 YEAR COST: $97M

POLICY OBJECTIVE: Place all overage and unreliable line equipment on a rational life cycle replacement basis in order to reduce service delays due to line equipment malfunction.

ELEMENT DESCRIPTION: The transit system contains over 250 pump rooms equipped with more than 800 pumps and over 160 fan chambers containing more than 200 fans. More than 75% of this equipment is over 40 years old. Maintenance costs are high, replacement parts are not available or are inadequate. Many of our fans and equipment are obsolete and inefficient by present standards, with overall poor reliability.

Ventilation projects included in this revitalization effort involve the replacement/upgrading of obsolete equipment to provide for increased capacity and versatility, as well as increased reliability. Ventilation equipment rehabilitation projects generally include the removal of fans, motors and other existing electrical equipment; structural modifications as required; the installation of new vane axial fans, A.C. service, lighting, heating and associated electrical and mechanical equipment.

Throughout the subway network pumping equipment is located at low points to discharge accumulated water. Program efforts under this category include the purchase and installation of new pumps, replacement of obsolete equipment, the installation of automatic alarm systems to alert command centers if water continues to rise to unacceptable levels, additional electric services, replacement of pipes, heating and lighting systems.

Tunnel lighting throughout most of the subway system is provided by original equipment which was installed as much as 75 years ago. Existing incandescant tunnel lighting will be replaced to provide a better light level.

Power cables and equipment at critical locations will be upgraded and modernized. Existing equipment will be removed and new, more energy efficient systems providing higher levels of illumination together with lower maintenance costs will be installed. Generally, the projects will also include new/reinforced electrical services, distribution equipment, cable and fixtures.

The objective of the 5 Year Program will be to accomplish the following:

Ventilation Facilities	Modernize 23 locations
	New 2 locations
Tunnel lighting	30 Miles
Pumping Facilities	23 Locations

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-6	Replace existing tunnel lighting systems (MW18), Rehabilitate/ replace pumping facilities (MW19), Rehabilitate ventilation facilities (MW24) and Rehabilitate power facilities (MW25).	A	8	30	35	12	12	97	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Line Structures

CATEGORY NO.: T-7

GOAL: Upgrade existing rapid transit structures.

5 YEAR COST: $199M

POLICY OBJECTIVE: Rehabilitate deteriorating rapid transit structures.

ELEMENT DESCRIPTION: Elevated and on-grade structures which have settlement, deterioration and corrosion problems will be reinforced, repaired or replaced. Typical concrete and structural elements to be rehabilitated includes angles, webs, stringers and cross girders, lateral bracing, columns, column footings, retaining walls, embankments, canopy roofs and manholes. Subway structures which have water infiltration problems will be waterproofed, repaired or rebuilt to prevent ground water inflow. In addition, drainage systems will be installed and other measures taken as required. Wooden platforms and mezzanines will be replaced with precast concrete.

At the end of this program all platforms on the system will be concrete with the exception of the Franklin Avenue Shuttle. Structural modifications to upgrade and rehabilitate ventilation systems will also be included where required such as gratings, ducts, drip pans, concrete slabs and curbs.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-7a	Remedy water conditions (MW12), Replace wooden platforms (MW20) and replace discharge, fire and water lines (MW30).	A	13	11	20	7	7	58	
T-7b	Rehabilitate structures various lines (MW22).	A	31	15	31	42	22	141	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Signals and Communications — CATEGORY NO.: T-8

GOAL: Replace elements of the signal system so as to bring components to life cycle standards.

5 YEAR COST: $500M

POLICY OBJECTIVE: Attain, then maintain a rational replacement cycle for rapid transit signal and communication systems.

ELEMENT DESCRIPTION: The principal function of the signal system is to provide safe and efficient rapid transit operations. The transit system contains over 10,000 signals, approximately 2,500 track switches, 8,700 automatic train stops, 110,000 relays, 12,000 track circuits and numerous other components. Approximately 94 miles of track will be resignalled during the next five years. Objectives of the signal modernization program are to upgrade safety standards and to improve service and reliability.

Typically, a complete signal modernization includes the removal and replacement of signals, train stops, switch machines, relays, messenger and signal cable, telephone cable, fire protection and detection systems and other associated equipment.

The communication system consists of telephone, radio and trainmaster's talkback systems. Much of this system is over utilized and past its economic life.

Sixty-six miles of new telephone cable will be installed along with associated equipment. Radio antenna cable in 12 tunnels will be replaced, a new system wide communication system will be installed and a trainmaster talkback system will link approximately 200 signal towers and dispatchers' offices to the command center.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-8a	Replace signal relay code system (MW14) and Modernization of signal system (MW38). (Zone Contracts)	A	4	82	50	117	74	327	
T-8b	Replace signal relay code system (MW14) and Modernization of Signal System (MW38), Non-Zone Contracts	A	3	70	9	25	5	112	
T-8c	Modernize telephone cables and equipment (MW17), antenna cable replacement (MW42) and Install Maintenance of Way communication system (MW43).	A	3	5	10	17	26	61	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Power

CATEGORY NO.: T-9

GOAL: Modernize the power distribution system and establish and maintain a rational replacement cycle.

5 YEAR COST: $301M

POLICY OBJECTIVE: Replace aged and unreliable components of the power distribution system.

ELEMENT DESCRIPTION: The Authority presently operates 190 substations converting A.C. power to D.C. for use on the railroad. More than 50% of the equipment used is older than the 35 years. Equipment deemed obsolete are: machines requiring 25hz input; manually operated machines; long cable feeders and ducts; and mercury arc rectifiers installed in the 1930s. Replacement equipment is to be automatically controlled transformers and solid state silicon rectifiers.

At the outset of the 5 year program the Authority expects to construct 26 new substations and re-equip ten others on the IRT/BMT system. On the IND system 31 units will be re-equipped.

At the end of this program 19 old substations will be closed and the Authority will be operating a total of 214 substations. Remaining for conversion on the IRT/BMT system at this time will be five 25hz, manually operated, rotary stations; two 25hz, mercury arc, automatic stations; and eleven 60hz, mercury arc stations. On the IND system 53 units will remain to be re-equipped.

The benefits of this program include:

a) Increased reliability inherent with solid state devices.

b) Lower power losses due to more efficient power equipment and shorter cable feeds.

c) Decreased labor costs due to replacing manned substations with automatics.

d) Decreased power surcharge costs for maintaining 25hz supply.

e) Higher reserve power for the longer, faster and air-conditioned cars anticipated for the future.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-9a	Replace/modernize/ add substations on IRT/BMT system (PW02 & 03).	A	52	70	41	51	46	260	
T-9b	Re-equip IND sub-station with silicon rectifiers (PW04) and Modernize elevators at 126 W. 53 St. Substation (MW05).	A	8	9	11	13	-	41	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Shops | CATEGORY NO.: T-10

GOAL: Modernize/Rehabilitate Rapid Transit shop facilities. | 5 YEAR COST: $432M

POLICY OBJECTIVE: Shop improvements will be made in order to improve maintenance of the rapid transit fleet and improve productivity within the shops.

ELEMENT DESCRIPTION: Existing shop and inspecition barn buildings generally date prior to 1930 and are deficient in modern equipment and adequate employee facilities. Some have only D.C. power supply which prevents the use of more efficient A.C. powered tools and equipment. To overcome these deficiencies, A.C. lighting and power contracts were recently completed in the two main repair shops (Coney Island and 207th St.) and five of the inspection barns.

Shop rehabilitation progams will include improvement of existing inspection facilities by providing additional pits, modernizing existing pits, improving drainage, improving lighting and general upgading. Additionally, new machne tools, new cranes and other modern equipment will be purchased for maintenance of the car fleet. Further improvement to the existing buildings will be made such as power and lighting, heating and ventilation, materials handling facilities, door, replacement of roofs, repair of structural defects, locker room facilities, etc.

The rapid transit system is suppoted by 13 inspection and trouble barns and two main shops. They will all be upgraded. A "total" rehabilitation concept will initiate the restoration of shops and barns to a state of good repair.

ELEMENT NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
T-10a	Advance a continuing shop modernization/ rehabilitation program (CM03), Replace outmoded and inefficient mechanical and motorized shop equipment (CM05), Replace/rehabilitate elevator in shop buildings (MW05),	A	19	96	63	-	1	179	

ELEMENT NO.	DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-10a (continued)									
	Construct new maintenance shop facilities (MW27), Advance a heating system and boiler replacement program (MW29), and Repair/replace roofs of various shops (MW41). (over $35M).								
T-10b	Advance a continuing shop modernization /rehabilitation progam (CM03), Rehabilitate employee facilities (MW08), Construct new maintenance shop facilities (MW27), Advance a heating system and boiler replacement progam (MW29), Rehabilitate shop buildings (MW33) and Repair/replace roofs of various shops (MW41). (Under $35M)	A	15	70	59	58	51	253	

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Yards CATEGORY NO.: T-11

GOAL: Improve operations and productivity by yard improvements and expansion 5 YEAR COST: $350M

POLICY OBJECTIVE: Improve service reliability and productivity. Reduce noise levels in residential areas by reducing main line track storage. Added yard storage will reduce vandalism and graffitti.

ELEMENT DESCRIPTION: There are 22 yards located throughout the system utilized for car storage, car inspection and car overhaul/maintenance operations. To store, inspect and maintain the R.T. car fleet in a more efficient manner, it is necessary to upgrade equipment and tracks. Yard track, switches and signals, power distribution, drainage and lighting will be rehabilitated, thereby providing for more expeditious movement of cars within the yards. Plant equipment will be upgraded as part of a continuing equipment replacement program. A yard security program will be included to reduce unauthorized yard entry and reduce vandalism and graffiti. Under this program, six yards will be rehabilitated.

To store, inspect and maintain the R.T. car fleet in a more efficient manner, it is also necessary to expand or replace equipment and tracks. The modernization of these yards will permit more efficient inspection, maintenance and cleaning of rapid transit cars, thereby improving service to the public. Yard track, switches and crossovers, power distribution, signals and line equipment will be expanded in order to improve rapid transit service reliability. Also, noise levels in residential areas will be reduced due to decreased main line track storage. Under this program, three locations in two yards will be expanded.

A "total" rehabilitation concept will initiate the restoration of the yards to a state of good repair.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-11a	Rehabilitate yard facilities (MW09, PP02) (over $20M)	A	2	37	-	3	62	104	
T-11b	Rehabilitate yard facilities (MW09, PP02) (under $20M)	A	2	54	27	24	6	113	
T-11c	Yard expansion/ improvements (TR03). Replace contact rail (MW11), Rehabilitate power facilities (MW25), Install new hydrant system (MW30), Yard lighting (MW31) and Construct additional storage tracks (MW33).	A	10	23	38	59	3	133	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Depots CATEGORY NO.: T-12

GOAL: Rehabilitate, modernize and replace existing bus storage and repair facilities. 5 YEAR COST: $308M

POLICY OBJECTIVE: To improve service reliability through improved maintenance facilities. Improve productivity and reduce vandalism and graffitti through improved storage facilities.

ELEMENT DESCRIPTION: The Transit Authority currently operates 22 bus storage and maintenance facilities which average 50 years of age, the oldest of which is past 95. Their age is complicated by the fact that many were not originally built to house a modern bus fleet. As part of the 5 year program, five depots will be replaced, new central storage bus maintenance, truck maintenance and administrative facilities will be constructed and 10 depots will be rehabilitated/modernized, including new mechanical and motorized equipment. In addition, the equipping of the entire surface radio system will be completed including the purchase of 3,900 bus radios.

			COMMITMENTS PER CALENDAR YEAR						
NO.	ELEMENT DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
T-12a	Replace base stations and radio systems (SF03), Replace mechanical and motor equipment (SF04) and Modernize/rehabilitate bus depot and repair facilities (SF07).	A	18	40	17	4	4	83	
T-12b	Construct new and additional bus depots and repair facilities (SF06). (over $25M9	A	53	77	2	56	5	193	
T-12c	Construct new and additional bus depots and repair facilities (SF06). (under $25M)	A	1	7	24	-	-	32	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Service Vehicles CATEGORY NO.: T-13

GOAL: Replace overaged service vehicles and expand the work train fleet. 5 YEAR COST: $53M

POLICY OBJECTIVE: Modernize the fleet of service vehicles and expand the work trains fleet in order to support an expanded capital revitalization program.

ELEMENT DESCRIPTION: The Transit Authority currently maintains a fleet of approximately 450 steel wheeled vehicles utilized for rapid transit and maintenance operations. Included in this service fleet are diesel locomotives, crane cars, rail grinders, rail welders, flat cars, hopper cars, pump cars, wash/detergent cars, and other miscellaneous cars.

This program provides for the purchase of the following:

35 Diesel Locomotives
24 Flat Cars
38 Ballast Cars
30 Rider Cars
3 Crane Cars
1 Rail Grinder
1 Rail Changer

Automotive trucks and vans are needed to move men and material and to service the surface fleet. Approximately 150 vehicles will be purchased in the 5 year program.

Typically, these vehicles will be replaced based upon one of three criteria; years of service, miles of use, or cost of repairs.

Various pieces of maintenance equipment will also be acquired, such as compressors, welders, engine analyzers, lathes, testing and shop equipment.

	ELEMENT		COMMITMENTS PER CALENDAR YEAR						
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
T-13	Replace maintenance equipment and machinery (MW06), Replace automotive trucks and service vehicles (MW07, SF05) and Replace/add work trains (MW10).	A	46	2	1	2	2	53	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Security Systems CATEGORY NO.: T-14

GOAL: Improve Passenger Security 5 YEAR COST: $21M

POLICY OBJECTIVE: To reduce crime incidents and provide a safe environment within the transit system.

ELEMENT DESCRIPTION: A concept of "Off-Hour Waiting Areas" to reduce crime incidents in rapid transit facilities by congregating passengers in designated station areas while waiting for trains during the off-hours has been developed. These areas are highlighted by the use of signage, higher intensity lighting, floor, wall and ceiling surface treatment and other graphic designations, and have been located to be visually monitored by a T.A. employee. Train annunciators also will be provided in appropriate locations where required to enable the passengers to leave the designated areas in time to board the desired train. CCTV at Waiting Areas is being evaluated and the results will be available in early 1983. A determination then will be made, whether to proceed with the installation of CCTV in waiting areas on a system wide basis.

Waiting Areas are being provided at 137 stations as a part of a program already underway. Under this program Waiting Areas and Waiting Areas with Annunciators will be provided at the remaining 328 stations on the system. By the end of this 5 year Capital Program all of the rapid transit stations on the system will be equipped with waiting areas.

By implementing this program, passenger security will be improved.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-14	Station annunciators, improvements to waiting areas; CCTV (PL03).	A	4	4	4	4	5	21	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: New Routes

CATEGORY NO.: T-15

GOAL: To provide interim operation on the new Queens routes.

5 YEAR COST: $180M

POLICY OBJECTIVE: To utilize the existing portions of the new routes program.

ELEMENT DESCRIPTION: The purpose of the new routes program is to relieve overcrowding on major subway trunk lines such as the IND Queens Boulevard Line, provide added capacity for future ridership growth, and open unserved areas within the City to direct subway service.

Changes which have occurred during the last decade, coupled with a rapid deterioration of the existing subway infrastructure, has forced a re-evaluation of capital spending priorities. Accordingly, the major emphasis over the next five years will be to re-establish, and then maintain, reliable operations on the existing rapid transit system.

To utilize the existing portions of the new routes construction, interim operations will be established, starting in 1984.

The East 63rd Street Line (Route 131-A) will provide service to the northern portion of Manhattan CBD, Roosevelt Island, and Long Island City in the vicinity of 21st Street.

The Hillside Connection (Route 131-D) will provide direct service from the Queens Boulevard Line to the Jamaica Business District. The Jamaica El connection (Route 133) will allow the existing Jamaica El to be demolished east of the connection at 127th Street on Jamaica Avenue thereby stimulating renewal of the Jamaica Business District.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-15	Construct and equip new Queens routes (EN12).	B	169	7	4	-	-	180	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

September 25, 1981

NYCTA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: Emergency/Miscellaneous CATEGORY NO.: T-16

GOAL: Provide resources for emergency conditions and future contingencies. 5 YEAR COST: $239M

POLICY OBJECTIVE: To provide for miscellaneous individual needs which do not fall within established programs.

ELEMENT DESCRIPTION: This category has been established to account for individual needs which do not fall within other programs.

The following classifications of work are included:

Management Information Systems

Systems will be developed and implemented to improve the flow of information in a number of key areas within the Authority.

Systems will be progressed for:

- Ridership/Scheduling/Work Assignment
- Planning, Operating and Financial Control
- Material/Maintenance Management
- Data Base Management
- Word Processing

Miscellaneous

Individual projects which do not fit within the other programs are included in this category. They are:

- Rapid Transit employee facilities which are not located in yards.

- Renovation of police district offices located at 161st Street and Hoyt Schermerhorn. Purchase of 12 driver training simulators.

- Improvements to Rapid Transit Operations such as new crossovers at East 180th Street and Brighton Beach, and a train dispatch system for the A and B Divisions. The train dispatch system consists of control turrets on each of the radio consoles in the Jay Street Command Center to be linked to all towers, dispatchers and yardmaster locations in the A and B Division.

- New or improved maintenance facilities and equipment which are not located in yards. New facilities such as Bridge Street in Brooklyn will be constructed. Existing facilities such as Carroll Street, Bergen Street and Jay Street will receive various improvements such as heating and boiler replacement and roof replacement.

Emergency and Contingency

Funds have been set aside in each year of the 5 Year Program for contingencies, emergency work, new work (such as a completion of the New Routes Alternatives and preliminary enginering and other work which cannot be defined at this time.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
T-16a	Management Information System (IE-02).	A	6	6	5	2	1	20	
T-16b	Emergency/Contingencies.	A	18	29	36	47	50	180	
T-16c	Miscellaneous Individual Projects (MW-01, MW08, MW27, MW29, MW33, MW41, PL01, ST01, TR01, TR02).	A	23	8	5	1	2	39	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SECTION II A 4

STATEN ISLAND RAPID TRANSIT OPERATING AUTHORITY

Specific Project Objectives, Program Goals and Plan

STATEN ISLAND RAPID TRANSIT OPERATING AUTHORITY

GOALS AND OBJECTIVES

PASSENGER STATIONS

The goal of this program is to provide stations with a commodious environment, safe and reliable equipment and structures, and improvements for the elderly and visually handicapped.

Most of the systems 22 stations were never modernized although the St. George Terminal was rebuilt in the early 1950's and five stations were rebuilt in the early 1960's under a grade crossing elimination project. Three stations were extended in the early 1970's to permit the berthing of three-car train units.

As part of the five year program, platform extensions will be constructed at eleven SIRTOA stations to permit the berthing of four-car train units at all SIRTOA stations. Also, badly deteriorated stations at two locations will be replaced. They are constructed of timber and present a fire hazard.

TRACK

The goal of the track program is to provide safe and reliable train operations through track rehabilitation.

Many sections of track roadbed are presently in a deteriorated condition and beyond normal maintenance repair.

New trackwork with welded rail was installed in early 1960's under a grade crossing elimination project. Also, selective replacement of track and roadbed has taken place since the early 1970's.

As part of the 5 Year Program, track and contact rail will be replaced at various locations along the right-of-way. Selective replacement will include rails, ties, ballast, crib walls, contact rails, protection boards, and all necessary accessories. Most of this equipment was originally installed in 1925.

A "Wye" track located at St. George Terminal must be realigned to provide additional capacity for turning four-car train units. The existing wye track is limited to a two-car capacity. The increased capacity would permit a reduction in the number of switching movements and save energy consumption.

LINE EQUIPMENT

The goal of this program is to provide reliable operation of support systems.

Most of the systems line equipment, including the signal system, has not been modernized since 1925. The long range objectives of a signal modernization program are:

1. Improved service by allowing increased running speeds, further use of track capacity, establishing shorter headways and better schedules.

2. Reduced signal interruptions to service and improved system and operational reliability.

As part of the 5 Year Program, the Tottenville Interlocking will be replaced.

The Tottenville interlocking plant controls train movements into and out of the terminal station as well as the adjacent train storage yard. Seven track switches must be replaced with power operated switches, remotely controlled from Tower "B" at St. George Terminal. This installation will eventually result in an annual operating savings of four man-years.

POWER

The goal of the power program is to provide a reliable system operation by supplying continuous power at minimal cost.

SIRTOA currently has four rotary converter substations in operation. Improvements have not been made since the original installation in 1925. A fifth new substation has been completed at Grant City and will be placed in operation shortly. A future substation, beyond the 5 Year Program, is planned for Huguenot.

As part of the 5 Year Program, power supervisory control equipment will be installed at St. George Substation to centralize control of seven equalizer breakers located along the right-of-way. Present practice requires that maintenance personnel travel to breaker locations when a substation fails and power is lost. Centralizing control of power transfer will provide for a rapid restoration of power to the affected section of the railroad.

Rotary converters that have been in service for more than 55 years must be replaced with modern silicon rectifier equipment. Existing substations located at St. George, Eltingville, and Atlantic will each be equipped with 2-2000 KW silicon rectifiers.

A new substation will be constructed and equipped to replace Old Town Substation. The existing Old Town Substation is a critical power supply for the operation of the railroad. The new substation is required to maintain a reliable operation.

SHOPS

The goal of the shops program is to provide efficient and effective maintenance centers within an environment conducive to good employee morale.

Maintenance and repair of SIRTOA rolling stock is accomplished at the Clifton Shops facility. An expansion of the car barn and various other shop improvements has recently been completed, although most shop equipment is the original installation.

A maintenance shop and service garage has recently been completed at Tompkinsville.

As part of the 5 Year Program, machine tools located at Clifton Shops will be replaced. The tools are used in connection with the maintenance and repair of R-44 passenger car equipment and work train equipment. The existing machine tools are old and worn beyond their useful life and must be replaced.

SECURITY

The goal of the security program is to reduce incidents of crime and vandalism and provide a safe environment within SIRTOA.

Under previous programs, a train to wayside communications system was installed, as well as CCTV at the St. George Terminal.

As part of the 5 Year Program, cyclone fencing will be replaced in selective areas along the railroad right-of-way. The fencing is required to maintain safety and security, and to deter trespassers and vandals.

EMERGENCY/MISCELLANEOUS

The goal of the emergency/miscellaneous program is to provide funds to repair/replace structures and equipment, the nature of which cannot be determined at this time.

Projects in this category could include, but would not be limited to structures, track, signals, power or rolling stock.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: PASSENGER STATIONS

CATEGORY NO.: S-1

GOAL: Modernize Stations

5 YEAR COST: $5.8M

POLICY OBJECTIVE; Platform extensions are required at eleven SIRTOA stations to permit the berthing of four-car train units. The constant increase in ridership demand mandates this improvement.

ELEMENT DESCRIPTION: Pleasant Plains and Princess Bay stations are both constructed of timber. They are badly deteriorated and present a fire hazard. The existing station facilities must be demolished and reconstructed with new fireproof platforms, canopies, shelters, stairways, and all other components necessary for complete operational stations.

			COMMITMENTS PER CALENDAR YEAR						
NO.	ELEMENT DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
S-1	Station Rehabilitation; Pleasant Plains and Princess Bay, extend platforms; Dongan Hills to Great Kills and extend platforms at five stations; Eltingville to Atlantic	A	.96	-	1.68	-	3.20	5.84	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: TRACK

CATEGORY NO.: S-2

GOAL: Upgrade track to provide for reliable operations.

5 YEAR COST: $2.3M

POLICY OBJECTIVE: Attain and then maintain a rational track replacement cycle and improve flexibility of operations.

ELEMENT DESCRIPTION: Track and contact rail must be replaced at various locations along the right-of-way. Selective replacement would include rails, ties, ballast, crib walls, contact rails, protection boards, and all necessary accessories. Most of this equipment was originally installed in 1925.

A "Wye" track located at St. George Terminal must be realigned to provide additional capacity for turning four-car train units. The existing wye track is limited to a two-car capacity. The increased capacity would permit a reduction in the number of switching movements and save enerby consuption.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
S-2	Track and Contact rail replacement and realign "wye" track at St. George.	A	0.61	0.36	0.40	0.44	0.48	2.29	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: LINE EQUIPMENT

CATEGORY NO.: S-3

GOAL: Upgrade equipment to provide for a reliable operation.

5 YEAR COST: $3.0M

POLICY OBJECTIVE: Attain, then maintain a rational replacement cycle for line equipment.

ELEMENT DESCRIPTION: The Tottenville interlocking plant controls train movements into and out of the terminal station as well as the adjacent train storage yard. Seven track switches must be replaced with power operated switches, remotely controlled from Tower "B" at St. George Terminal. This installation will eventually result in an operating savings of four man-years.

	ELEMENT		COMMITMENTS PER CALENDAR YEAR						
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
S-3	Replace Tottenville Interlocking	A	-	-	-	3.0	-	3.0	

Costs in millions of dollars, escalated at 10 percent per year from 1980 to reflect inflation.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: POWER

CATEGORY NO.: S-4

GOAL: Upgrade the power system to provide a reliable operation.

5 YEAR COST: $11.0M

POLICY OBJECTIVE: Replace aged and unreliable components of the power distribution system.

ELEMENT DESCRIPTION: Installation of power supervisory control equipment at St. George Substation will be required to centralize control of seven equalizer breakers located along the right-of-way. Present practice requires that maintenance personnel travel to breaker locations when a substation fails and power is lost. Centralizing control of power transfer will provide for a rapid restoration of power to the affected section of the railroad.

Rotary converters that have been in service for more than 55 years must be replaced with modern silicon rectifier equipment. Existing substations located at St. George , Eltingville, and Atlantic will each be equipped with 2-2000 KW silicon rectifiers.

Construct and equip a new substation to replace Old Town Substation. The existing Old Town Substation is a critical power supply for the operation of the railroad. The new substation is required to maintain a reliable operation.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
S-4	Supervisory Control of Equalizer Breakers, Substation Equipment and Substation Enclosure		1.10	9.03	-	-	0.90	11.03	

Cost in millions of dollars, escalated at 10 percent per year from 1980 to reflect inflation.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SHOPS CATEGORY NO.: S-5

GOAL: Replace obsolete equipment 5 YEAR COST: $0.6M

POLICY OBJECTIVE: Tools at the shop will be replaced to improve maintenance of the carfleet and improve shop productivity.

ELEMENT DESCRIPTION: Machine tools located at the Clifton Shops are used in connection with the maintenance and repair of R-44 passenger car equipment and work train equipment. The existing machine tools are old and worn beyond their useful life and must be replaced.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
S-5	Replace Machine Tools	A	-	0.60	-	-	-	0.60	

Costs in millions of dollars, escalated at 10 percent from 1980 to reflect inflation.

September 25, 1981

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SECURITY

CATEGORY NO.: S-6

GOAL: Provide security for the transit system.

5 YEAR COST: $0.4M

POLICY OBJECTIVE: Reduce crime incidence and provide a safe environment within SIRTOA.

ELEMENT DESCRIPTION: Cyclone fencing will be replaced in selective areas along the railroad right-of-way. The fencing is required to maintain safety and security, and to deter trespassers and vandals.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
S-6	Replace Cyclone Fencing; various locations	A	0.06	0.06	0.07	0.07	0.08	0.34	

Costs in millions of dollars, escalated at 10 percent per year from 1980 to reflect inflation.

SIRTOA

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: MISCELLANEOUS — CATEGORY NO.: S-7

GOAL: Emergency Repair Programs — 5 YEAR COST: $1.9M

POLICY OBJECTIVE: Make funds available for the emergency repair or replacement of any type of system components.

ELEMENT DESCRIPTION: This work could include structural, track, signal, electrification or rolling stock.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
S-7	Misc. Emergency Repairs	A	0.30	0.40	0.40	0.40	0.40	1.9	

Costs in millions of dollars, escalated at 10 percent per year from 1980 to reflect inflation.

SECTION II A 5

FINANCING PLAN

NYCTA/MaBSTOA/SIRTOA

FINANCING PLAN
NYCTA/MaBSTOA/SIRTOA

As part of the requirements outlined for capital program plans in the Transportation System, Assistance and Financing Act of 1981, each plan must "set forth an estimate of the amount of capital funding required each year and the expected sources of such funding." The preceding section has established the capital funding requirements, by year of program commitment, for the NYCTA and related agencies. The table below identifies the expected sources of funding for the elements to be committed for each year's capital program. It should be noted, however, that the funds that will support the projects for any given year will not necessarily be raised in that same year. In particular, the revenue bonds identified as the probable source for car financing are shown as supporting commitments in the early years of the program. However, based on delivery schedules, these bonds will be sold in later years. Part III-B of this report, containing supporting materials on financing, explains the strategy and timing of raising capital to undertake the plan.

NYCTA/MaBSTOA/SIRTOA
Financing Plan by Year of Commitment
($ in millions)

	1982	1983	1984	1985	1986	TOTAL
Program Commitments	$2,146	$1,031	$1,160	$ 819	$ 655	$5,811
Expected Funding Source*						
Federal	440	395	333	365	400	1,933
State	110	87	-	-	-	197
City	165	100	100	100	100	565
Port Authority	29	29	30	-	-	88
Other	-	90	-	-	-	90
TBTA Bonds	-	-	195	288	79	562
ASC Bonds	-	300	96	-	-	396
Revenue Bonds	1,121	24	326	60	69	1,600
Lessor Equity	281	6	80	6	7	380
TOTAL	$2,146	$1,031	$1,160	$ 819	$ 655	$5,811

*Prior to and concurrent with permanent financing by any of these means, preliminary funding through short-term borrowing or acceptance financing or other temporary funding mechanisms may be obtained. Vendor terms for payment for particular capital elements or particular components of capital elements constituting transit projects may be sufficiently favorable to avoid the necessity for or to represent an attractive alternative to financing the cost thereof through the issuance of MTA special obligation revenue bonds. If favorable extended term vendor financing is available, the amount of revenue bonds included in the above table would be reduced by the amount of such vendor obligations. Such vendor obligations would, however, constitute "contractual obligations" within the meaning of Sections 1207-m and 1266-c of the Public Authorities Law and the capitalized value of such obligations would be included in the computation of the maximum amount of obligations the NYCTA is permitted to incur in connection with transit projects pursuant to Section 1207-m.

SUBMISSION FOR

MTA CAPITAL PROGRAM REVIEW BOARD

CAPITAL PROGRAMS

for

MTA COMMUTER RAIL SYSTEMS

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LONG ISLAND RAIL ROAD

METRO-NORTH
(MTA Portions of Conrail)

II B 1.1 September 25, 1981

CAPITAL POLICY OBJECTIVES - GENERAL
MTA COMMUTER RAILROADS

The magnitude of the capital requirements for commuter railroads (LIRR and Metro-North, the MTA portions of Conrail) is very great. As articulated in the Capital Revitalization Report of 1980, the cost to accomplish a complete rehabilitation over a ten-year period would be over $2 billion dollars for Metro-North and $3.6 billion for the Long Island Rail Road. New routes and major improvements will cost $719 million more for Metro-North and $1.7 billion for the Long Island Rail Road for the 1981-1990 period.

It is unlikely that the Authority can obtain all of these funds during the 1980s. Instead, priorities have to be established for the use of funds which will be made available.

In order to accomplish this, a comprehensive capital planning process has evolved three primary goals:

- Maintain a reliable commuter rail operation. This includes purchasing passenger cars for all commuter services to meet the present and near future requirements. While it has been the policy to try to provide a seat for all passengers in the past, many thousands of commuters presently are forced to stand. There has been a steady increase in ridership without a corresponding increase in car fleet. With the addition of these new cars, there will be an added strain on the existing shop and yard facilities which are not even adequate to handle the present fleet. For this reason this item also includes improved maintenance facilities to maintain the cars.

- Ensure a long term survival and a safe, reliable transportation system with reasonable operating costs. Past trends of allowing the existing system to deteriorate must be reversed. We have to make available the funds necessary to maintain, modernize and upgrade the commuter rail system's vital components in a state of good repair.

- Other improvements to the existing system. Such improvements include improving commuter rail car availability and system environment, increasing commuter rail system capacity and advancing presently identified programs.

A detailed breakdown of more specific policy objectives in the context of these program goals (as well as the costs involved), are shown on the following pages.

The present 5 year capital plan for the Long Island Rail Road and Metro-North does not fund all of the needs identified in the Revitalization Report of 1980. As a result, some programs will be deferred. Other programs will have their implementation period extended. Examples of programs that will have to be deferred are the LIRR plan to add a third track eastward to Hicksville and the Metro-North program to install cab-signalling on the Hudson-Harlem lines between Mott Haven and Grand Central Station. Examples of programs that will have to have their implementation extended are the LIRR and Metro-North plans for interlocking modernization.

With respect to those elements of the projects which involve the improvement of facilities generally available to the public, every reasonable effort will be made to plan and design such elements with consideration to the special needs of elderly and physically handicapped persons.

The Transportation System Assistance and Financing Act of 1981 requires the identification of specific capital elements. The Act provides for two types of capital elements; one with a specified maximum dollar amount proposed to be expended - which we have designated an A element, and one with a particularly described capital project within one or more categories for which no maximum expenditure is proposed, but for which an estimate of expected cost is provided which we have designated a B element. The legislation also makes various references to categories.

The specific identification of the elements, their classification - A or B - the description of the work to be accomplished and an estimate of the annual level of commitment is contained on the following pages. The elements are stated as subsets of their appropriate category. Where there is only one element in a category, they both carry the same designation. However, where there is more than one element in a category each element carries a specific identifier or reference number.

The following coding structure has been developed to specifically identify categories and elements by Agency.

T = NYCTA/MaBSTOA Project
S = Staten Island Rapid Transit Operating Authority Project
L = Long Island Rail Road Project
M = Metro-North Project

Thus, New Cars L-1, a category, has only one element. As a result that element is also designated L-1. Shops and yards, category L-6, has two elements. They are identified as L-6a and L-6b. The elements for the LIRR are detailed on pages II B 3.10 through II B 3.26. The elements for Metro-North are detailed on pages II B 4.12 through II B 4.22.

The capital program elements to be advanced by the MTA as "The 5 year Capital Program 1982-86" as authorized by the Transportation Systems Assistance and Financing Act of 1981 for the MTA commuter railroads are as follows:

	5 YEAR COMMITMENT ($ in millions)	
	LIRR	METRO-NORTH
CLASS A ELEMENTS		
ROLLING STOCK & BUSES		
New Cars (LIRR/HH)	$252.5	$176.5
New Cars (NH)		71.6
Rehabilitated Cars	-	29.4
		$277.5
PASSENGER STATIONS	16.2	23.3
TRACK	75.9	-
LINE STRUCTURES	67.2	29.2
SIGNALS & COMMUNICATIONS	28.5	74
POWER EQUIPMENT, EMERGENCY POWER EQUIPMENT & SUB-STATIONS	-	193.5
SHOPS, YARDS, MAINTENANCE FACILITIES, DEPOTS & TERMINALS	101	25.2
SECURITY SYSTEMS	3.1	-
UNSPECIFIED, MISC. & EMERGENCY	29.9	41.3
Subtotal CLASS A	$574.3	$664
CLASS B ELEMENTS		
PASSENGER STATIONS		
Penn Station Access	$ 15	-
ELECTRIFICATION EXTENSIONS		
Upper Harlem Electrification	-	$ 10
Northport Electrification	35.7	-
SHOPS, YARDS, MAINTENANCE FACILITIES, DEPOTS & TERMINALS		
Harmon Shop	-	10
West Side Storage Yard	58	-
Subtotal CLASS B	$108.7	$ 20
TOTAL	$683	$684

SECTION II B.2

MTA COMMUTER RAIL ROADS

Performance Measurements

September 25, 1981

PERFORMANCE MEASUREMENT
MTA COMMUTER RAILROADS

GENERAL

The MTA's Five Year Capital Program 1982-1986 was developed from the Revitalization Report of 1980. The prime objective of the Revitalization Report was to identify, in relatively specific terms, the work that must be accomplished if the accelerating deterioration of the MTA transportation facilities is to be halted and if we are to be able to restore the system to a state of good repair. A failure to accomplish those objectives will surely lead first to increased passenger discomfort, then further deterioration of the system, increased unreliability, and finally an absence of proper levels of safety. Any safety risks will result in gradually shutting the system down, for we will not operate an unsafe system.

It is our belief that this Five Year Capital Program makes a significant start in the direction of revitalization of the system. We would hope to complete most of those tasks during a second Five Year Program.

The true measure of the success of this program is in the increased level of service experienced by the public. In more specific terms the measure of the program is the difference between the level of service that would be produced if this program were not advanced - and the general deterioration were allowed to continue - and the level of service that will be provided.

The measures of accomplishment that follow are comparisons between the present levels and the levels we believe the program will achieve. The comparison is "limited" in this way because a comparison with a forecast of what service would be like, absent these capital improvements, is too subjective and/or theoretical to be meaningful and is dependent on many factors beyond the scope of this program.

The above is not meant to suggest that more specific measures are not necessary. They are necessary and we continue to work towards developing both the standards of measurement and the data required to use them. Just as we have made great strides, over the past several years, in the process of setting priorities for capital projects, we believe we can make major strides in the more specific measurement of the interrelationships among the components of our transit systems. To have deferred the initiation of this program until the precise measures of specific interrelationships among elements on the performance of the total system were quantified in detail would be foolhardy: much of the system is nearing collapse and secondly, the cost of the program, at today's rates of inflation, is increasing by $60 million each month it is delayed.

The following is a series of measurements of present and projected performance of the system as a whole and, as appropriate, selected components of the system. Each of the performance measurement factors identifies the factor being measured, provides the present and anticipated levels, and identifies the capital programs that contribute to the improvement. These system-wide and selected component performance measurement factors are in addition to the numerous measurement factors discussed in the context of the descriptions of each elements.

This analysis responds to the statutory call for service and operational standards together with a statement relating capital investment to these measures.

LONG ISLAND RAIL ROAD

This plan is an integrated program that works toward eliminating bottlenecks without transferring the problem to other areas. Each piece of the plan is designed to reinforce the other pieces to provide the passengers and taxpayers with maximum benefits for the dollars spent. Each of these program elements is inter-dependent. The capacity provided by the West Side Yard and improvement to our basic infrastructure will maximize our ability to improve and/or increase service. Furthermore, increasing service without modernizing our facilities to maintain the equipment with which we deliver the service would diminish the impact of the entire program.

The benefit to the passenger will be felt in many ways. The new cars will allow us to reduce the current 5,300 standee (east of Jamaica) situation. However, with the continued anticipated increase in ridership, there will still be approximately 6,000 people standing east of Jamaica and additional standees west of Jamaica before the West Side Yard allows for an increase of peak hour trains. In 1986, with the West Side Yard operational the standees east of Jamaica will be reduced to 3,600.

NUMBER OF STANDEES OVER 20 MINUTES (East of Jamaica)

AM Peak Period

Present	5,300
Objective 1986	3,600
Percent Improvement	32%

Passengers arriving in Penn Station today are delayed up to 11 minutes to exit from track level. In the future, the time will be reduced to only six minutes. Faster clearance of the platform will allow the railroad to schedule more trains through the station tracks and therefore obtain the maximum effect of the capacity of the West Side Yard. The passenger will be able to move to and from the platforms at a much more comfortable level of service.

CLEARANCE TIME REQUIRED FOR PASSENGERS TO GET FROM PENN STATION PLATFORM LEVEL TO CONCOURSE DURING MORNING PEAK PERIOD

Present	11 minutes
1986	6 minutes
Percent Improvement	46 %

The railroad will be able to effect other productivity improvements due to the implementation of the Capital Program. However, much of the immediate impact will be in improved service reliability rather than in a reduction in the number of employees. The West Side Yard will reduce overall deadhead miles by 39%. The equipment will also be available in the West Side Yard Shop for several hours since it will not deadhead to Jamaica for repairs or storage.

RATIO OF REVENUE CAR MILES TO EMPTY CAR MILES

(Following West Side Yard Implementation)

Present	17.1%
1986	10.4%
Percent Improvement	39%

The double tracking and electrification extension will allow for increased utilization and productivity of equipment and crews. The interlocking improvements and centralized control will allow for significant productivity improvements specifically by reducing the number of tower operators.

The additional cars will allow trainmen to move through trains and collect revenue that is currently missed on overcrowded trains.

The shops are being designed to achieve maximum productivity improvements which will be reflected in significant increases in the number of cars overhauled.

The Capital Plan for the Long Island Rail Road is not a panacea for all of the railroad's inadequacies, some of which date back to the 19th century. The LIRR will, however, publicly demonstrate that given an opportunity to make substantial improvements in its physical plant and increase available equipment, the railroad can more adequately fulfill its responsibilities to the public as a dependable transportation system.

At the end of the Five Year Capital Program now under discussion, improvements to the railroad such as the West Side Yard, reverse signalling between Penn Station and Jamaica, and improvements for the shops will be completed.

Furthermore, the new cars themselves incorporate modifications to increase reliability and will permit an accelerated overhaul program for existing cars. All of these actions will contribute to increased reliability for the railroad which will be reflected in improved on-time performance and shortened average delays.

In this Five Year Plan the railroad has attempted to find a satisfactory compromise between the recognized need for increased reliability and the recognized need for increased capacity. However, the key bottleneck of Jamaica will have little additional capacity added during this period due to the sequential nature of the track and signalling changes that must be first designed and then implemented. Thus, all trains except those on the Port Washington Branch must squeeze through this bottleneck (including the new trains being added). By 1986, the interlocking modernization will begin to increase train capacities and improve overall operations.

The new cars will add capacity and comfort. The new shops will extend the life of the existing equipment and improve its comfort and appearance. These items should improve the dependability of the equipment. On the other hand, the very existence of a fleet of 216 new cars, the lengthening of the trains and the new trains that will be added will increase the complexity of the operation and may work to offset some of its improvements in service that would otherwise have resulted.

Accordingly, the first and most positive effect will not be in the on-time performance as such, but rather the length of a typical delay. When breakdowns do occur, train dispatchers will have the ability to move the following trains around the problem and mitigate the delays.

ON-TIME PERFORMANCE

Year	Morning Peak Period	Typical Morning Peak Period Delay Length
1981	80.6%	11.2 minutes
1986	90 %	8.0 minutes
Percent Improvement	12 %	28%

On-time performance during the past three years has averaged 81.5%. In the morning peak hour during this same period on-time performance was 79.7% (in March '81 it was 80.6%). In the same period a sampling of delays shows an average 10.4 minutes per train delay (in March '81 it was 11.2 minutes). The objective is to increase the total on-time performance to 92% in 1986 (to 90% in the morning peak period) and to reduce the average delay to eight minutes.

As further improvements are made, particularly to the Jamaica bottleneck, it may be possible to improve on-time performance further, unless increased demand requires the railroad to run more trains and give up some of the operating flexibility contributed by the new capacity.

METRO-NORTH

At the present time, standee conditions represent one of the major shortcomings of the Harlem, Hudson, and New Haven Line train service. The following chart documents present conditions and the goal for 1986:

NUMBER OF STANDEES OVER 20 MINUTES - A.M. PEAK

	Hudson & Harlem	New Haven
August 1981	4,000	1,500
Projected 1986	0	0
Percent Improvement	100%	100%

Antiquated shop facilities on the Region have been unable to keep pace with required repairs, contributing to the current condition of the car fleet. The "out-of-service"rate on all types of equipment rose steadily as ridership was increasing due to the energy crisis and other factors. Regionwide, the current car shortage stands at over 60 cars per day with many cars stored as "unserviceable" in need of heavy repair. The delivery of 142 new M-3 cars will eliminate all standees only if supported by region-wide shop improvements that are included in this Program.

The modernization of Harmon Shop is essential to progress heavy repairs and overhaul programs in a timely fashion. Construction of a new shop at Brewster and expansion of the North White Plains shop are necessary to handle daily inspections and running repairs and avoid excessive deadheading to-and-from Harmon. The substitution of MU cars for locomotive hauled coaches in the Upper Harlem service will increase the need for shop facilities in that MU cars require more frequent inspection and repair than standard coaches. Shop management is now constantly burdened with the task of trying to make the best of inadequate facilities. Once shop modernization and expansion programs are

complete, management efficiencies will generate both a higher quality of repair work and increased shop output.

On-time performance has been unacceptably low for several years and is another major deficiency of the present service. Current on-time performance figures and the goal for 1986 are as follows:

A.M. PEAK PERIOD ON-TIME PERFORMANCE

	Hudson	Harlem	New Haven
August 1981	*84.7%*	*86.2%*	*84.0%*
Projected 1986	95.0	95.0	95.0
Percent Improvement	12.1	10.2	13.1

Equipment failures alone caused over half of the train delays. The capital program improvements will reduce train delays in other critical areas as well. New car purchases and shop improvements will eliminate delays caused by excessive standees and overcrowding as well as reduce mechanical breakdowns enroute. The FL-9 locomotives used in the Brewster service are prone to frequent breakdowns. The electrification of the Upper Harlem Line will eliminate this cause of delays. Switch and signal failures are another major cause of train delays. The installation of cab signals regionwide and centralized trafic control on portions of the railroad not presently so equipped will eliminate many of these delays. On the New Haven Line, the obsolete power supply system exceeds equipment failure as the major cause of train delays. Completion of the ongoing conversion from 25Hz to 60Hz power and the elimination of Cos Cob will end these power related delays. On the Harlem and Hudson Lines, the power supply system is not currently a significant cause of train delays but will become so if the obsolete rotary converter substations remain in service much longer. Replacement of the rotary converters is essential to avoiding a replay of the New Haven Line's power problems on the Harlem and Hudson over the next five years. By the completion of the Five Year Capital Program in 1986, on-time performance should approach 95% region-wide.

In addition to improving the reliability, comfort, safety and efficiency of the Metropolitan Region rail operation, the Five Year Capital Program will have a positive impact on the annual operating budget by reducing manpower requirements in several significant areas. Thse reductions include, but are not limited to the following:

- The conversion of existing rotary converter substations to solid state apparatus will eliminate the need for operating engineers who presently man these stations on a 24 hour basis. After the elimination of some 70 jobs in this classification, 20 new positions will be established for the maintenance and operation of the new system. This will result in a net reduction of approximately 50 positions for a total annual savings in excess of one million dollars.

- The electrification of the Upper Harlem Line and the purchase of 82 additional M-3 electric cars will result in the elimination of all firemen positions on trains operating between GCT and Brewster North. This eliminates 30 positions at a savings of over $500,000 per year.

In addition to the above, other cost savings which cannot be easily quantified will result from this program. As an example, the construction of new MU shop facilities at Brewster and the expansion of existing shop facilities at North White Plains will reduce excessive deadhead car mileage between North White Plains and Harmon and between Brewster and North White Plains. This results in a savings in crew cost and power consumption. "Three tracking" of the Hudson Line will eliminate 20 miles of main line track with its associated annual maintenance cost. The installation of cab signals and centralized traffic control (CTC) between Mott Haven Tower (MO) and Brewster North on the Harlem Line and between MO and Poughkeepsie on the Hudson Line will eliminate several interlocking towers, many of which are manned around the clock. This function will be performed by train dispatching forces presently located at 347 Madison Avenue resulting in additional cost savings not yet fully determined.

SECTION II B.3

LONG ISLAND RAIL ROAD

Specific Project Objectives, Program Goals and Plan

LONG ISLAND RAIL ROAD

SPECIFIC CAPITAL PROJECT OBJECTIVES AND PROGRAM GOALS

MAINTAIN A RELIABLE OPERATION

Provide additional seating for passengers through purchase of new cars: While the railroad has tried to provide seats for passengers in the past, many thousands of commuters are presently forced to stand. There has been a steady increase in ridership without a corresponding increase in car fleet.

The Long Island Rail Road has sustained continued ridership growth especially during rush hours. In the last seven years, peak period arrivals have increased by 37 per cent at Penn Station. Over 12,000 commuters presently stand from 20 and 65 minutes every day. Station dwell times are substantially increased as people take longer to enter and leave crowded trains. This adversely affects on-time performance. Providing seats for these standees will not only improve performance but also enhance passenger perception of the railroad.

An order has been placed with the Budd Company for the purchase of 70 M-3 cars. One car of each "married pair" is to be equipped with two "tie-down" positions for wheel chairs and also be provided with a portable ramp to bridge the gap between the car and platforms.

Under this program, it is the Authority's intention to exercise the option in the original bid package and purchase an additional 146 cars. One car of each pair of the cars to be ordered as a part of this Five Year Plan will also be equipped with two wheelchair positions.

Delivery of the initial order of M-3 cars to LIRR is expected to begin in first quarter 1983 at a rate of 20 cars per month. All 216 cars will be delivered in early 1984.

As each pair of cars is put into service, fewer passengers will have to stand. The new cars will have an immediate benefit of providing more attractive service for our increasing ridership, reducing station dwell time and increasing the ability to collect all fares.

Modernize and/or construct new car maintenance facilities: With the addition of new cars to the rolling stock fleet, there will be an added strain on the existing equipment maintenance facilities which are not adequate to maintain the present fleet.

The Long Island Rail Road has shops for maintaining electric and diesel cars at several locations. However, many of these shops were constructed before the turn of the century. At the present time, diesel cars are serviced outdoors at Richmond Hill for lack of an enclosed facility. Morris Park Shops, which were constructed in the 1890s, serve as the locomotive inspection/repair facility as well as the main shop facility for the electric commuter cars. Because all of the major maintenance and overhaul programs must be done at the one shop facility at Morris Park, a major program for upgrading and modernizing equipment maintenance facilities is proposed in accordance with the Mechanical Facilities Master Plan Study.

The initial shop construction, to be operational in 1983, will raise the maintenance level and dependability of our diesel car fleet which is maintained at the Richmond Hill facility. 45,000 passengers in our non-electrified territory benefit from the increased reliability of our diesel car fleet. At the same time, the additional improvements in the overall Shop Facilities Program will be phased-in, beginning in 1984.

The total cost of the initial phases of the program (Phases 1 through 4 including starting the Holban Yard periodic inspection facility) is $177 million. $76 million is funded with "pre-1982" funds consisting of $20M 1979 State Bond funds and $56M "pre-1982" Federal funds. The balance, to be funded with 1982-86 funds is $101 Million.

ENSURE LONG-TERM SURVIVAL & A SAFE, RELIABLE SYSTEM

Modernize then maintain a replacement cycle for system components: Past trends of allowing the existing system to deteriorate must be reversed. We have to make available the funds necessary to modernize and maintain the commuter rail system's vital components in a state of good repair.

The Long Island Rail Road has 39 interlocking locations of various sizes and complexities. Jamaica, with three interlockings, is the largest such facility on the LIRR. Each day 553 trains pass through Jamaica Interlocking. This includes all trains to and from the New York terminals with the exception of the Port Washington Branch trains. This program includes engineering, design and implementation of the first phase of a series of improvements to the present interlocking in a manner which will reduce the number of conflicting train movements while generally modernizing the interlocking machine with all electric components.

Most Long Island Rail Road interlockings are presently controlled from individual block stations. Interlockings can be either

electromechanical or all electric. Electro-mechanical interlockings require the operator to manually move levers, which display signal and line and move the necessary switches. Electric interlockings use relays or microprocessor logic to translate miniature lever movements to switch operations. Under this program which is part of a multiphase plan, all interlockings will eventually be modernized. In addition, a central control operations center will be constructed at Jamaica. This will include model boards of the entire railroad which will permit monitoring and control of all trains.

Design of the improvements for Jamaica Interlocking must be done in two stages. The first stage, designing the civil improvements, will take approximately eighteen months and will impact on the three separate towers and interlockings that actually make up the overall Jamaica complex. This must be followed by the intricate signal design work that will take approximately the same length of time to complete. Installation of the new components will then take place. Accordingly, we anticipate that in 1986 the first signs of the improvements being made in the Jamaica area will become apparent to the traveling public.

Penn Station handles 458 LIRR trains and over 200 NJDOT Conrail and Amtrak trains each day. The towers, track and switching configuration date back to 1910 and were not designed for the density of today's traffic. The switches and controls must be redesigned to handle additional modern, high speed 12 car trains.

The antiquated switching system and towers will be modernized, consolidated and remotely controlled from a new control center. To increase capacity and improve overall operations the terminal superintendent, trainmaster, stationmaster and police functions will be centralized there.

These improvements will facilitate faster train movement into and out of the terminal as well as increased operating flexibility when problems occur. It will mean increased dependability and improved on-time performance for LIRR passengers who use Penn Station each day.

Divide Interlocking will also be upgraded to allow three trains to move east of Hicksville Station simultaneously. Signal, electric traction and other associated work will be included. Divide Tower will also be modified. At present 177 daily Port Jefferson, Main Line, Ronkonkoma and Montauk Branch trains pass through Divide Interlocking.

<u>Upgrade system components, thereby providing additional operating flexibility</u>: The advancement of this program is absolutely necessary to provide replacement of system components that are

approaching the end of their useful service life. In upgrading the existing systems, improvements will be made that will increase operating flexibility and on-time performance.

The existing signal system on the 11.2 miles of Main Line track between Jamaica and Penn Station permits only one-directional flow on each track. Over 480 LIRR trains use this portion of the railroad everyday. The installation of reverse signalling, automatic speed control and a new interlocking at Rego Park will permit operation against normal flow of traffic (reverse signaling.) Trains can then be rerouted quickly around stalled trains on any one of four tracks.

Reverse signalling, when used with the LIRR West Side Yard, will further increase flexibility. The total cost of this program is $27.5M. "Pre-1982" funding is providing $9M for this project.

Harold Interlocking, a complex network of tracks, switches and signals in Long Island City, routes all train movements to/from Penn Station and Hunterspoint Avenue. Amtrak Northeast Corridor service is also routed through this interlocking.

Present operating restrictions at Harold, compounded by the magnitude of train traffic, result in longer journey-to-work time for commuters. These conditions also increase the probability of LIRR train delays between Jamaica and Penn Station. Harold must therefore be modernized to improve existing service and provide for future needs. Present funding is for the required design and engineering.

Reverse signalling improvements will take 18 months to design and three years to construct. Reverse signalling on the four tracks between Jamaica and Penn Station will become operational in 1986, and at that time the public will benefit from the increased capacity and flexibility in this heavily traveled portion of the railroad. The additional funding required is $18.5 Million

As previously indicated, reverse signalling allows trackage to be used in either direction with complete automatic protection. Without it, a track is restricted to either automatic operation in one direction only or manual block rules. Reverse signalling provides the flexibility to reduce delays and provide faster service. It also allows more than one track on a branch to be used in the same direction during peak periods, in some instances, doubling the potential service that can be provided.

A program at a cost of $10M is included herein for the installation of improved signalling on the Montauk Branch, such as reverse signalling between Valley and Hall and other improvements east of Babylon. This will increase the operating flexibility and dependability for Babylon, Long Beach, Far Rockaway, West Hempstead,

Speonk and Montauk trains, carrying over 50,000 passengers during the morning rush hours.

IMPROVE CAR AVAILABILITY

Improve commuter rail car availability: Due to extremely limited storage facilities west of Penn Station, 97 trains must be moved to outlying storage yards as far east as Babylon during off-peak hours. This causes numerous delays, uses track capacity for unproductive purposes and increases the number of non-revenue service miles. If a disruption of service occurs in the East River Tunnels, these deadhead trains are unavailable for peak hour service. The productive use of the East River tunnels is also reduced.

Plans for the LIRR West Side Storage Yard include storage for at least 320 M-1 and M-3 cars, a maintenance facility for inspection and light repairs, an interior cleaning platform and an exterior carwash. The yard will be joined to Penn Station via a four track lead. Completion of this project will enable the LIRR to expedite train movement and achieve a 25 per cent increase in trains during the peak period. The total cost of this program is $158M. $26M has been committed for site acquisition and engineering. The total remaining cost of the program is $132 million. $74 million of this is funded with "pre-1982" funding. The balance to be funded with 1982-86 funds is $58 Million.

The West Side Yard will be operational in 1985. This program will allow additional trains and cars to be scheduled in order to relieve congestion and standing conditions that exist on all of our rush hour trains.

IMPROVE STATIONS

Modernize station and terminal facilities: In order to improve the system environment for the hundreds of thousands of daily commuters who utilize the commuter rail system, certain types of station improvements will be made. The definite improvements for individual stations have not been determined but may include: improved lighting and signage, escalators, ramps, elevators, shelters, waiting room improvements, platform reconstruction and extensions.

The proposed improvements at Penn Station are designed to increase comfort and convenience for Long Island Rail Road passengers. Improved passenger circulation is essential especially during rush hours when fully loaded trains arrive and depart at close intervals.

The arrival interval will be shortened with the completion of West Side Storage Yard and therefore clearance of platform stairways and concourses become a critical issue.

Adequate access must be provided to ensure that overcrowded conditions do not exist at stairs and escalators. The two directional flow between platform and concourse exceeds *40,000 people during the peak hour*. Improvements include the installation of high-speed escalators to safely expedite the smooth flow of passengers. Additional stairways will be constructed to increase passenger circulation and assure uniform distribution along the platform. Air-conditioning improvements will also be made to the Long Island Rail Road concourse level at Penn Station. All platforms used by LIRR trains will be made accessible to elderly and handicapped persons.

INCREASE SYSTEM CAPACITY

Provide second main line track in single track areas: Certain areas of the Long Island Rail Road presently have only one mainline track over which to operate trains. This results in delays, service disruptions and limited service. In order to increase the capacity of these single track areas and provide more timely and convenient service, second tracks will be added to two of the most heavily travelled portions of the LIRR.

Ridership on the Port Jefferson Branch has increased 40 per cent since 1973 and is expected to continue this steady increase. There are presently 24,500 passengers using this branch of the LIRR each morning. The additional track between AMOTT interlocking (Syosset) and Northport will make it possible to both increase service and make it more reliable.

The 17-mile track segment between Republic and Ronkonkoma is on the fastest growing branch on the railroad, with approximately 6,600 morning rush hour commuters. These improvements will allow more trains to be scheduled, operating at closer headways, and permit reverse travel to/ from Ronkonkoma during peak travel periods.. The Ronkonkoma Branch serves the middle of the Long Island Corridor where much of the industry is located and where job opportunities for reverse commutation already exist. Installation of a second track would be the initital step in improving service on this branch.

It is anticipated that the introduction of the two tracks to both Northport and Ronkonkoma will be handled as concurrent projects. Accordingly, it is anticipated that these projects will take 18 months to design and three years to construct. The operational improvements and increased reliability of second main tracks

should benefit the operation when they are completed in 1985. All work to be accomplished within existing LIRR right of way.

NEW ROUTES

Extend electrified passenger service: The Port Jefferson Branch is one of the LIRR's most heavily traveled lines. Extending electrification and installing reverse signalling for approximately five miles between Huntington and Northport will provide over 2,500 rush hour passengers with improved service as well as providing adequate diesel/electric transfer facilities.

As part of the electrification extension, two new high level side platforms (each 12 cars long) will be constructed at Greenlawn; at Northport a new high level island platform (12 car lengths) will be built. Also included at both stations will be pedestrian ramps, overpasses, canopies, platform shelters and new station lighting. All work to be accomplished within existing LIRR right of way.

This program in conjunction with the installation of the second track between Huntington and Northport will provide improved commuter service on the Port Jefferson Branch.

SECURITY

Provide security improvements at stations and other railroad facilities: Security improvements such as fencing, lighting and CCTV will be installed at various locations.

In addition security will be upgraded at some ticket offices by adding alarm systems for police and fire protection and CCTV systems.

UNSPECIFIED, EMERGENCY MISCELLANEOUS WORK

Emergency Repair Programs: Make funds available for the emergency repair or replacement of any type of system component. This could include structural, track, signal, electric traction, or rolling stock. An example of such a repair would be the development of a severe structural problem, such as the collapse of a tunnel wall or bridge member for which funds do not exist.

NASSAU COUNTY BENEFITS IN
MTA/LIRR 5 YEAR CAPITAL PROGRAM

New M-3 Cars

The acquisition of the new M-3 cars will allow the LIRR to add cars on to trains that are currently overcrowded. As trains arrive at Nassau County stations, especially those on a west end of a zone, there are frequently no seats available and crowded conditions exist. The adding of cars to existing trains and the introduction of new trains will provide the Nassau County commuter with increased service and capacity to New York.

Shop Facilities

The shop improvement program will provide modern facilities to repair the M-1/M-3 electric cars. Since almost all of Nassau County has electrified service the commuters in this area will receive the benefit of improved performance availability and reliability due to the improved maintenance of the fleet. Passengers riding the diesel hauled coaches on the Oyster Bay branch will see the improvements provided by the new repair facility for this equipment, which is the first phase of the shop program.

Station Improvements

Since most major stations are within Nassau County the passenger from these stations will see various improvements such as escalators, canopies and at busy Mineola station, a pedestrian overpass will be built at the west end of the station.

A new station between Hicksville and Syosset is being included in the program. This station will relieve the highly congested parking conditions at Hicksville and Syosset by providing a 3,000 car parking lot in the vicinity of the old Landia station. The new station is dependent on other governmental authorities providing funding for parking, access roads and, as needed, grade separation.

Penn Station

Approximately eighty percent of LIRR passengers from Nassau County are destined for Penn Station. Therefore, virtually all of the Nassau passengers will benefit from the improvements on the west end of the Long Island Rail Road. Approximately 128,000 Nassau County passengers pass through Penn Station each day.

Passenger improvements within Penn Station will include air-conditioning and ventilation improvements, increased movement

areas at concourse level and increased access to the platforms. Today's passengers are delayed getting from track level to concourse level due to insufficient stairways. To solve today's problem and the increased density of traffic once the West Side Yard is open additional platform access (stairs, escalators and handicapped elevators) will be installed. The modernization of Penn Station switching will reduce delays through this 1910 facility and support the increased capacity through the station made possible by the West Side Yard.

West Side Yard

The single most important element of the program in terms of the improvement of the operation of the entire LIRR is the construction of the West Side Yard. This project will improve Penn Station capacity by 25%, increase operating efficiency, reliability and provide improved opportunity for maintenance of the equipment. All of these benefits will accrue to all riders on the LIRR and epecially those from Nassau County.

Other Improvements

Reverse signalling improvements between Jamaica and New York will improve service and eliminate most delays caused by stalled trains for passengers using Penn Station and Hunterspoint Avenue. Modernization of Jamaica interlocking and centralized control should reduce train congestion at Jamaica and improve service for all passengers at Jamaica. Over 260,000 commuters transfer at or pass through Jamaica each day.

Signalling improvements on the Montauk Branch will effect Nassau commuters who pass through the Valley Stream to Jamaica Corridor; this area will be provided with Reverse Signalling.

SUFFOLK COUNTY BENEFITS IN
MTA/LIRR 5 YEAR CAPITAL PROGRAM

Additional Track to Northport

A second track installed on the heavily used Port Jefferson Branch will provide the additional capacity required to operate an increased number of trains and a more dependable operation. This project, in advance of the electrification to Northport, will improve service on the entire branch for 12,300 passengers east of Syosset. The increased operating flexibility provided by a two track line would make rush hour service more reliable by enabling the scheduling of trains on either or both tracks, when necessary. It would also enable eastbound morning rush hour trains to operate beyond Hicksville; this is virtually impossible with single track operation. A second track would eliminate problems inherent with single track operations and permit the smooth flow of equipment to and from Northport, resulting in improved passenger service for 26,000 Port Jefferson Branch A.M. commuters.

Electrification Extension - Huntington to Northport

Electrification will provide direct access to Penn Station and Flatbush Avenue for 2,700 peak period commuters boarding at Greenlawn and Northport. It will further allow the almost 4,000 A.M. peak period passengers east of Northport the option to transfer to M-1/M-3 trains at Northport, which will be constructed to allow for easy transfer. The current transfer facility at Huntington is inconvenient and time consuming. It will significantly reduce the number of commuter transfers from diesel to electric service, improve the level of passenger service and permit faster, more efficient train operations. The Port Jefferson Branch is one of the LIRR's heaviest traveled lines, used by 26,000 A.M. commuters. Extending electrification will improve service on the entire branch enabling economical service to be added during off peak periods between Port Jefferson and Northport.

Additional Track Ronkonkoma Branch

Installing a second track equipped with reverse signalling and automatic speed control on the Ronkonkoma Branch from PW (Republic Station) to Ronkonkoma will eliminate the present single track operations. This is the fastest growing branch on the railroad; ridership has increased by 62% since 1973. Daily A.M. ridership exceeds 6,800 people. Installation of the second track would be the initial step in improving service on this branch both for passengers and freight users. This would allow more trains to be scheduled, to operate at much closer headways, and permit reverse commutation to Ronkonkoma. This project will provide

improved service to the industrial growth area in the central corridor of Long Island.

New M-3 Cars

The acquisition of the new M-3 cars will allow the LIRR to terminate selected diesel trains at the beginning of electrified territory and run express electric service direct to Penn Station. This will provide Suffolk passengers with the option to transfer at eastern locations and eliminate the need to transfer at crowded Jamaica and in some cases allow non-stop service to Penn Station, such as is presently done with the 7:21 from Babylon which has a diesel connection from Patchogue. The value of the new M-3 cars will especially be felt on the Port Jefferson Branch where the extension of electrification to Northport will allow an easy transfer and fast service to Manhattan. With the added cars the Suffolk County passenger transferring to M-1/M-3 cars will face less crowded conditions than they currently endure.

Shop Facilities

The first phase of the Shop Improvement Program is the construction of a new Diesel Hauled Coach Repair facility; thus the just beneficiary of the new shop program will be diesel car riders, principally residents of Suffolk County. Today repairs to these cars are done outdoors in all kinds of weather. The new indoor facility will significantly improve productivity and the condition of the equipnment. These same passengers will also benefit from the remaining shop improvements which will improve M-3 and Diesel Locomotive repairs and will result in improved availability and reliability of equipment.

Penn Station

Approximately eighty percent of LIRR passengers from Suffolk County are destined for Penn Station. Therefore, virtually all of the Suffolk passengers will benefit from the improvements on the west end of the Long Island Rail Road. Approximately 56,000 Suffolk County passengers pass through Penn Station each day.

Passenger improvements within Penn Station will include air-conditioning and ventilation improvements, increased movement areas at concourse level and increased access to the platforms. Today's passengers are delayed getting from track level to concourse level due to insufficient stairways. To solve today's problem and the increased density of traffic once the West Side Yard is open additional platform access (stairs, escalators and handicapped elevators) will be installed. The modernization of Penn Station switching will reduce delays through this 1910 facility and support the increased capacity through the station made possible by the West Side Yard.

West Side Yard

The single most important element of the program in terms of the improvement of the operation of the entire LIRR is the construction of the West Side Yard. This project will improve Penn Station capacity by 25%, increase operating efficiency, reliability and provide improved opportunity for maintenance of this equipment. All of these benefits will accrue to all riders on the LIRR and especially those from Suffolk County.

Other Improvements

Reverse signalling improvements between Jamaica and New York will improve service and eliminate most delays caused by stalled trains for passengers using Penn Station and Hunterspoint Avenue. Modernization of Jamaica Interlocking and centralized control should reduce train congestion at Jamaica and improve service for all passengers at Jamaica. Over 260,000 commuters transfer at or pass through Jamaica each day.

Signalling improvements on the Montauk Branch will not only affect Suffolk commuters who pass through the Valley Stream to Jamaica Corridor, which will be provided with Reverse Signalling, but also this program calls for signal improvements East of Babylon.

The other improvements such as Station and Security improvements will also benefit Suffolk County residents using the many stations within the county.

New Station

The new station between Hicksville and Syosset (vicinity of Landia Station) will benefit Suffolk commuters due to its easy access off the Long Island Expressway. Commuters using the Central Island Corridor may find this a convenient location to drive to, park, and take the train to Manhattan. The new station is dependent on other governmental authorities providing funding for parking, access roads and, as needed, grade separation.

SUMMARY

While this document does not permit the execution of all programs identified in the first five years of the Revitalization Report of 1980, it does provide sufficient funds to initiate major programs which have been identified as highest priority. This document identifies projects with a total cost of $683 million which the Long Island Rail Road has selected as top priority programs.

This document advances strategies for the use of total anticipated capital construction funds. Should funds in excess of the anticipated $683 million identified become available, additional programs can be initiated.

This program is the first step towards establishing a more reliable operation and the long term survival of the LIRR. Past practices of deferring needed rehabilitation cannot continue. All the improvements herein will improve passenger safety, comfort and convenience and increase operating capacity, permitting better on time performance and reliability.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: CARS, NEW

CATEGORY NO.: L-1

GOAL: Provide additional seating for passengers through purchase of new cars.

5 YEAR COST: $252.5

POLICY OBJECTIVE: Improve the comfort, convenience and dependability provided to passengers by providing additional rolling stock.

ELEMENT DESCRIPTION: The Long Island Rail Road has sustained continued ridership growth, especially during rush hours. In the last seven years, peak period arrivals have increased by 37 per cent at Penn Station. Over 12,000 commuters presently stand from 20 and 65 minutes every day. Station dwell times are substantially increased as people take longer to enter and leave crowded trains. This adversely affects on-time performance. Providing seats for these standees will not only improve performance but also enhance passenger perception of the railroad.

Ridership during the peak AM period is expected to grow by 9,000 passengers in the next five years. Virtually all trains arriving in Penn Station from 7 - 9 AM have standees. The existing standees, plus the anticipated 9,000 new riders would result in overcrowding on virtually all peak period trains, if new cars are not received.

An order has been placed with the Budd Company for the purchase of 70 M-3 cars. Under this program, it is the Authority's intention to exercise the option in the original bid package and purchase an additional 146 cars. Delivery of the M-3 cars to LIRR is expected to begin in first quarter 1983 at a rate of 20 cars per month. At this rate all 216 cars will be delivered by early 1984. One car of each "married-pair" of cars of both the initial 70 car order and of the additional 146 car order will be equipped with two "tie-down" positions for wheelchairs and a portable ramp for bridging the gap between the car and platform.

The new cars, when they arrive, will significantly reduce the standee problem, but before 1986, because of the increase in ridership, there will be standees on some trains. During the subsequent five years, it may be necessary to expand the fleet further.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-1	Purchase of up to 216 new M-3 Electric Passenger Cars	A	252.5	-	-	-	-	252.5	(1)

(1) Includes 70 M-3 cars previously ordered at a cost of $77.5M.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: PASSENGER STATIONS | CATEGORY NO.: L-2

GOAL: Modernize stations. | 5 YEAR COST: $31.2M

POLICY OBJECTIVE: Station improvements will be made in order to improve system environment and safety for commuters.

ELEMENT DESCRIPTION: The proposed improvements at Penn Station, which serves 205,000 daily commuters, are designed to increase comfort and convenience for Long Island Rail Road passengers. Improved passenger circulation is essential especially during rush hours when fully loaded trains arrive and depart at close intervals. The arrival interval will be shortened with the completion of West Side Storage Yard and therefore clearance of platforms quickly becomes a critical issue. Increased access will also be provided for elderly and physically handicapped persons. Adequate access must be provided to ensure that overcrowded conditions do not exist at stairs and escalators. The two directional flow between platform and concourse exceeds 40,000 people during the peak hour. Improvements include the installation of high-speed escalators to safely expedite the smooth flow of passengers and assure uniform distribution along the platform. Penn Station will receive air-conditioning and ventilation improvements during the five year period.

Today, peak period trains are overcrowded. Congestion results when passengers queue to use the stairs and escalators. To alleviate the overcrowding at the east end and assure uniform passenger distribution at platform level, a new West End concourse will be constructed. It will provide direct access to the existing IND Eighth Avenue Subway Mezzanine from Platforms 7, 8, 9 and 10.

There is no air-conditioning system and inadequate ventilation in the LIRR portion of Penn Station. The passenger environment needs to be improved. Improvements will increase overall passenger comfort levels and reduce passenger walking distances and times.

In order to improve the system environment for the hundreds of thousands of daily commuters who utilize the commuter rail system, certain types of station improvements will be made. The definite improvements for individual stations have not been determined but may include: improved lighting and signage, escalators, ramps, elevators, shelters, waiting room improvements, platform extensions and general painting.

These improvements will improve conditions for passengers using these stations, and while they are on the platform waiting for trains, as well as improving the general appearance of stations.

They will help maintain a reliable commuter operation by improving passenger access at Penn Station and other line stations, and will improve the systems environment and also will begin to make the LIRR accessible to the elderly and physically handicapped.

A new Landia Station, to be located on the Port Jefferson Branch between Hicksville and Syosset has been proposed. This program provides funding for the railroad-related work. The implementation of this element is dependent on other governmental jurisdictions providing all required funding for parking, access roads and, if required, grade separation at Robins Lane.

ELEMENT			COMMITMENTS PER CALENDAR YEAR						
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
L-2a	Penn Station Passenger Access	B	1	2	5	7	-	15	
L-2b	Various Station Improvements including Elderly/ Handicapped access, extensions, signage	A	.4	1	.2	-	7	8.6	
L-2c	Landia Station	A	.6	1	4	1	1	7.6	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: TRACK

CATEGORY NO.: L-3

GOAL: Provide additional mainline track in single track areas.

5 YEAR COST: $75.9M

POLICY OBJECTIVE: Increase the capacity of single track areas and provide more timely and convenient service by adding second tracks to two of the most heavily travelled portions of the LIRR.

ELEMENT DESCRIPTION: Ridership on the Port Jefferson Branch has increased 40% since 1973, with 24,500 passengers during the morning rush hour period, and it is expected to continue this steady increase. The additional track between AMOTT interlocking at Syosset and Northport will provide both more reliable and increased service.

The single track severely restricts operations on the LIRR's second largest branch. The railroad's second largest station, Huntington, is located within this single track area. A breakdown on the single track during the AM peak period effects passengers as far west as New Hyde Park, since service to these stations originates in the single track area.

Fifteen westbound electric and diesel trains carrying 24,500 passengers require the almost exclusive use of the single track Port Jefferson Branch during the AM rush hours. Only one eastbound train is scheduled east of Huntington; no eastbound trains arrive at Huntington for almost 2 1/2 hours fromm 6:08 to 8:31 AM.

The increased operating flexibility provided by a two track line would make rush hour service more reliable by enabling the scheduling of trains on either or both tracks, when necessary. It would also enable eastbound morning rush hour trains to operate beyond Hicksville; this is virtually impossible with single track operation. A second track would eliminate problems inherent with single track operation and permit the smooth flow of equipment to and from Northport, resulting in improved passenger service for 24,500 Port Jefferson Branch AM commuters. The frequency of service can be increased as well as providing service in reverse of the peak direction.

The 17 mile track segment between Republic and Ronkonkoma is the fastest growing branch on the railroad, with approximately 6600 morning rush hour commuters. These improvements would allow more trains to be scheduled, operating at closer headways, and permit reverse commutation to Ronkonkoma.

Ridership on this branch has increased by 62% since 1973. Installation of the second track would be the initial step in improving service on this branch. This would allow more trains to be scheduled, to operate at much

closer headways, and permit reverse commutation to Ronkonkoma. It would also be an important link to the proposed Ronkonkoma Transportation Hub. As on the Port Jefferson Branch, a breakdown on single track can close down the entire branch until the problem is cleared up, there is no way to get around a disabled train.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-3	Additional track to Northport and Ronkonkoma	A	-	13	27.9	21	14	75.9	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: LINE STRUCTURES

CATEGORY NO.: L-4

GOAL: Upgrade signal and switching facilities for improved operations.

5 YEAR COST: $67.2M

POLICY OBJECTIVE: Upgrade system components to improve reliability and dependability.

ELEMENT DESCRIPTION: The Long Island Rail Road has 39 interlocking locations of various sizes and complexities. Jamaica, with three interlockings, is the largest on the LIRR. Jamaica is the hub of the railroad; eight of the nine branches converge there. 553 revenue trains carrying over 250,000 passengers pass through this complex interlocking every day. Jamaica Station is the major transfer point for passengers destined for one of three western terminals. It is also the bottleneck of railroad operations. The Jamaica switching complex consists of three separate interlockings: "Hall" which controls all moves east of the station; "Jay" which controls moves on the Main Line and Montauk branches west of the station; and "Dunton" which routes all trains to/from Brooklyn and the Morris Park Shop Complex. Constructed in 1913, this interlocking can barely handle present train operations. Today, 42 rush-hour trains carrying 49,500 passengers run non-stop through Jamaica. However, these trains are required to operate at speeds restricted to 15 MPH on tracks also used by trains making Jamaica stops. This congested operation can quickly compound slight delays and deteriorate on-time performance

The need for expanded capacity through Jamaica Interlocking becomes more important as service increases. Over the next decade, LIRR service is expected to rise sharply due to continued ridership growth, acquisition of new cars, further electrification extensions and installation of additional main line track.

This program includes engineering and design of the present interlocking in a manner that will reduce the number of conflicting train movements while modernizing the switches with new electric interlocking components.

This will begin to increase train capacity and improve overall operations. Operational control to start to be centralized; towers will be remotely controlled resulting in more efficient train operations. Incrased operating flexibility, as well as faster train movement through the station, will result from these improvements.

Penn Station handles 458 LIRR trains and over 200 NJDOT Conrail and Amtrak trains each day. The towers, track and switching configuration date back to 1910 and were not designed for the density of today's traffic. The switches and controls must be redesigned to handle additional modern, high speed 12 car trains.

To increase capacity and improve overall operations, the antiquated switching system and towers will be modernized, consolidated and remotely controlled from a new control center. The terminal superintendent, trainmaster, station master and police functions will be centralized there.

These improvements will facilitate faster train movement into and out of the terminal as well as increased operating flexibility when problems occur. It will mean increased dependability and improved on-time performance for LIRR passengers who use Penn Station each day.

These improvements will begin to increase train capacity and improve overall operations. Operational control to start to be centralized; towers will be consolidated and remotely controlled resulting in more efficient train operations. Increased operating flexibility, as well as faster train movement into and out of the station, will result from these improvements.

Upgrade Divide Interlocking to allow three trains to move east of station simultaneously. During the AM rush hours, westbound Main Line and Port Jefferson trains must cross over the same section of track before they can enter Hicksville Station. This means if two trains arrive at the same time, one must stop and wait until the other train clears this section of track. The crossover will eliminate this problem. Divide Tower will be modified; signal, electric traction and other associated work will be included.

The new crossover will increase operational flexibility and reduce congestion at Divide Interlocking and Hicksville Station during peak periods. 177 Port Jefferson, Main Line, Ronkonkoma and Montauk trains pass through Divide Interlocking. Hicksville is the busiest commuter station on the railroad. Operational flexibility will be increased and on-time performance will improve when the new crossover is installed.

These improvements will increase system capacity and help maintain a more reliable, safer commuter rail operation.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-4	Modernize Jamaica Interlocking including Central Control, modernize Penn Station Switching and Control, and Upgrade Divide Interlocking	A	1	4	11.2	29	22	67.2	(1)

(1) Excludes "pre-1982" funds..

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SIGNALS — CATEGORY NO.: L-5

GOAL: Upgrade system components providing additional operating flexibility. — 5 YEAR COST: $28.5M

POLICY OBJECTIVE: Provide replacement of system components which are approaching the end of their useful service life. In upgrading the existing systems, improvements will be made to increase operating flexibility and on-time performance.

PROGRAM DESCRIPTION: The existing signal system on the 11.2 miles of Main Line track between Jamaica and Penn Station permits only one directional flow on each track. Over 480 LIRR trains use this portion of the railroad everyday. The installation of reverse signalling, automatic speed control and a new interlocking at Rego Park will permit operation against normal flow of traffic. Trains can then be rerouted quickly around stalled trains on any one of four tracks.

Increased capacity to New York is a high priority of the railroad. All service to Penn Station and Hunterspoint Avenue operates on the Main Line west of Jamaica. This portion of the railroad is used by almost 500 LIRR trains each day. During the peak hour, 40 trains, 20 per track, use the Main Line west of Jamaica in the peak direction.

Today, rush hour service is at capacity. A delay to a train on either of the two tracks in a particular direction limits the railroad's track capacity until the problem is cleared up.

Increased use of the Main Line between Jamaica and New York can be obtained by installing reverse signalling and automatic speed control on all four tracks and the four tunnels into Penn Station. This will elininate the delays resulting from a disruption in service by allowing train operation against normal flow of traffic. Trains can then be rerouted quickly around stalled trains on any one of four tracks, or three tracks can be operated in the peak direction eliminating much of the congestion on the Main Line west of Jamaica.

Increased operating flexibility becomes more critical for service reliability and improved on-time performance as more trains are operated to carry greater passenger volumes. Reverse signalling of existing tracks is a means to increase passenger carrying potential at only a fraction of the capital cost of construction of additional tracks.

Harold Interlocking, a complex network of tracks, switches and signals in Long Island City, routes all train movements to/from Penn Station and Hunterspoint Avenue. Amtrak Northeast Corridor service is also routed through this interlocking.

Harold was designed and built by the Pennsylvania Railroad in 1910, mainly to improve through service to Boston (via Hellgate Bridge). A secondary purpose was to facilitate Manhattan access for LIRR commuters who then used a ferry transfer from the Long Island City Passenger Yard. Since that time, Harold Interlocking routing has remained basically unchanged although LIRR traffic shifted in growing numbers to Penn Station.

Accordingly, very few LIRR train moves through Harold today are straight-line; most require at least two crossover moves at sharply reduced speeds. Most of the almost 500 LIRR trains proceeding through Harold each weekday are restricted to 30 MPH within interlocking limits.

In effect, Harold has become antiquated. The extensive converging and diverging moves, at sharply reduced speeds, intensifies train congestion - especially during peak periods. This condition is worsened by Amtrak and Conrail train movements through the East River Tunnels. Furthermore, there is limited flexibility at Harold to bypass trains in emergencies. If a train is stalled during one of the many diverging crossover moves, following trains on two tracks must be delayed.

Present operating restrictions at Harold, compounded by the magnitude of train traffic, result in longer journey-to-work time for thousands of commuters. These conditions also increase the probability of LIRR train delays between Jamaica and Penn Station. Harold must therefore be modernized to improve existing service and provide for future needs.

The scope of this program is for the redesign of Harold Interlocking to minimize conflicting moves between LIRR and Amtrak Northeast Corridor service. The tracks and switching networks will be realigned to provide for high-speed straight-through train service, eliminating many of today's diverging crossover moves at sharply reduced speeds. A newly designed configuration of crossovers and turnouts will provide the increased operating flexibility to bypass stalled trains if service disruptions occur.

As previously indicated, reverse signalling allows trackage to be used in either direction with complete automatic protection. Without it, a track is restricted to either automatic eastbound or westbound operation or manual block rules. Reverse signalling provides the flexibility to reduce delays and provide more reliable service. It also allows more than one track on a branch to be used in the same direction during peak periods, in some instances, doubling the service that can be provided.

A program is included for the installation of signal improvements on the Montauk Branch such as reverse signalling between Valley and Hall and other improvements east of Babylon. This will increase the operating flexibility and dependability for Babylon, Long Beach, Far Rockaway, West Hempstead, Speonk and Montauk trains, carrying over 50,000 passengers during the morning rush hours.

These improvements will increase system capacity and help maintain a more reliable, safer commuter rail operation.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-5	Jamaica to Penn Station Reverse Signalling, including Harold Interlocking and Signal Improvements on the Montauk Branch	A	-	-	7	13	8.5	28.5	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SHOPS/YARDS

CATEGORY NO.: L-6

GOAL: Modernize and/or construct new car maintenance facilities and improve car availability.

5 YEAR COST: $159M

POLICY OBJECTIVE: Improve maintenance facilities so that present and future car fleets can be properly maintained.

ELEMENT DESCRIPTION: The Long Island Rail Road has shops for maintaining electric and diesel cars at several locations. However, many of these shops were constructed before the turn of the century. At the present time diesel cars are serviced outdoors at Richmond Hill for lack of an enclosed facility. Morris Park Shops, which were constructed in the 1890s, serve as the locomotive inspection/repair facility as well as the main shop facility for both the diesel and the electric commuter cars. It is proposed that a major program be initiated for upgrading and modernizing equipment maintenance facilities in accordance with the LIRR Maintenance Facilities Master Plan Study.

The Long Island Rail Road currently maintains over 1,200 units of rolling stock consisting of electric passenger cars, diesel-hauled passenger cars, diesel locomotives and power generator units at 19th century facilities that were initially constructed for maintaining stean locomotives and smaller passenger coaches. As rolling stock was acquired, changes were made in the layout within constraints of the physical plant to adapt the facility for maintaining diesel locomotives and electric M-1 cars in addition to diesel-hauled cars.

The MTA Capital Program calls for purchasing 216 M-3 cars. The existing shops cannot adequately handle today's car fleet. A modern Shop Complex would be used to maintain both diesel and electric equipment servicing our 295,000 passengers. If a new shop complex is not constructed, the cars will continue to be inefficiently maintained, resulting in train malfunctions and passenger discomfort. Approximately 37 per cent of all train delays can be traced to mechanical problems.

The recommendations of the Master Plan include multiple phases of construction. The Five Year Capital Program completes funding for the first phases with a total cost of $177M. This program funds $101M of the total. A separate program will be undertaken simultaneously with Phases 1 and 2 which will relocate the present M of W and Stores Depts from Holban Yard to permit the construction of a periodic inspection facility for electric cars.

The first phase, which is funded with "pre-1982"funds, consists of the Richmond Hill Shop Improvements which includes a new main shop building which will accommodate eight diesel cars, a new stores and support facility building, realignment and reconstruction of the yard trackwork, and a new yard servicing system. There is no enclosed facility for diesel coach maintenance today. This

new facility will significantly improve the quality of diesel coach maintenance and will be readily noticeable by diesel commuters.

The next phases consist of various Morris Park Shop Improvements. Phase 2 includes construction of new paint shop and stores building. Some of the improvements within this phase include: a new secured car storage area; a new storage facility; a new paint shop for M-1 electric cars, and diesel hauled coaches and locomotives; a new wheel truing facility; a new air plant; and the necessary trackwork and electrification modifications to accommodate the work to be progressed as a part of this phase.

Another phase consists of the construction of a new electric car shop. The new shop will accommodate nine married pairs of electric cars, including two married pair locations with truck and body hoists for component changeout. Component shops to be incorporated into the new facility include the upholstery shop, the air conditioning repair area, switch group, jumper and contact repair area and the electronic shop.

Four out of five Long Island Rail Road passengers use Penn Station, and therefore, will benefit from the West Side Storage Yard. This project, the single most valuable project on the entire railroad, is expected to increase train capacity at Penn Station by over 25 per cent.

Peak hour operations at Penn Station, now at practical operating capacity, are further restricted by equipment (non-revenue) train moves. Over 450 LIRR trains, serving approximately 200,000 passengers, use Penn Station daily.

Limited storage capacity at Penn Station forces the railroad to operate 95 equipment trains. These trains are shuttled to facilities as far east as Babylon, 40 miles from New York, for mid-day storage and return to Penn Station for service during the evening rush hours. This shuttling operation hinders the smooth flow of trains to/from Penn Station during the rush hours and increases the potential for breakdowns and delays in service. This daily shuttling of equipment results in a total of 3.8 million deadhead (non-revenue) car miles annually. Elimination of this mileage will reduce operating costs.

Most LIRR trains, due to the physical restraints of Penn Station, are forced to turn at the platform. This increases platform dwell while reducing overall station capacity.

Construction of a West Side yard should improve the LIRR's dependability and on-time performance, as well as reduce annual operating expenses. Morning westbound trains to Penn Station will continue west to the yard reducing station dwell time and increasing LIRR-Penn Station tunnel and station track capacity approximately 25 per cent. Evening eastbound trains will start from the new yard, pick up passengers at Penn Station, then continue eastbound.

The new storage facility should reduce tunnel congestion and conflicting movements since one East River Tunnel will no longer be tied up with non-revenue train moves. This would result in the improved dependability and increased on-time performance for all railroads using Penn Station.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-6a	Shop Improvements in accordance with the Maintenance Facilities Master Plan Study.	A	18	26	27	15	15	101	(1)
L-6b	Construction of West Side Yard	B	16	30	12	-	-	58	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SECURITY

CATEGORY NO.: L-7

GOAL: Provide security improvements at stations and other railroad facilities.

5 YEAR COST: $3.1M

POLICY OBJECTIVE: Improve security for traveling public and LIRR facilities.

ELEMENT DESCRIPTION: There are minimum (none at some) security devices at most LIRR stations to protect railroad property and passengers.

Security improvements such as fencing, lighting and CCTV will be installed at various locations. In addition, security will be upgraded at some ticket offices by adding alarm systems for police and fire protection, and CCTV systems.

Increased security will result in a reduction in vandalism and theft of railroad property and reduced crimes against passengers and employees.

	ELEMENT		COMMITMENTS PER CALENDAR YEAR						
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
L-7	Security Improvements	A	.5	0	1.1	.7	.8	3.1	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: ELECTRIFICATION/EXTENSIONS CATEGORY NO.: L-8

GOAL: Upgrade system components increasing capacity. 5 YEAR COST: $35.7M

POLICY OBJECTIVE: Upgrade level of service provided.

ELEMENT DESCRIPTION: The Port Jefferson Branch is one of the LIRR's most heavily traveled lines. Extending electrification and installing reverse signalling for approximately five miles between Huntington and Northport would provide over 2,500 rush hour passengers with improved service as well as providing adequate diesel/electric transfer facilities.

It would further impact on the almost 4,000 passengers east of Northport who will benefit from the project. The frequency of off-peak service on the branch in both diesel and electric service can be increased. The present three sets of diesel equipment will be able to be better utilized and will allow the current 80 minute frequency of off-peak service to be (an easy to remember) 60 minute service. Electrification would enable the reassignment of Port Jefferson Branch diesel cars to cover other rush hour diesel service.

In 1970, electrification was extended on the Port Jefferson Branch. Huntington was not intended to be a terminal point for electric service, but rather the first step in a staged electrification project that would eventually encompass the entire branch.

In the eleven years since the electrification extension, Huntington has had to function as a less than optimal transfer point for diesel to electric service, with parking congestion and passenger inconvenience. One decade later, the population of the area has grown and energy costs have caused ridership to increase significantly. The diesel/electric transfer at Huntington, both time consuming and inconvenient for the passenger, will instead occur at Northport with a modern across-the-platform facility.

As part of the electrification extension, two new high level side platforms (each 12 cars long) will be constructed at Greenlawn; at Northport a new high level island platform (12 car lengths) will be built. Also included at both stations will be pedestrian ramps, overpasses, canopies, platform shelters and new station lighting.

This program, in conjunction with the installation of the second track between AMOTT (Syosset) and Northport, will provide improved commuter service on this section of the Port Jefferson Branch.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-8	Electrification to Northport	B	-	8.3	13.0	12.0	2.4	35.7	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LONG ISLAND RAIL ROAD

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: MISCELLANEOUS/EMERGENCY CATEGORY NO.: L-9

GOAL: Emergency repair programs. 5 YEAR COST: $29.9M

POLICY OBJECTIVE: Make funds available for the emergency repair or replacement of any type of system components.

ELEMENT DESCRIPTION: This work could include structural, track, signal, electric traction or rolling stock.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
L-9	Misc. Emergency Repairs	A	2.9	2	10.5	3.5	11	29.9	(1)

(1) It may be necessary to draw down these funds earlier than actually shown in the case of extreme emergency.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SECTION II B 4

METRO-NORTH
(MTA Portion of Conrail)

Specific Project Objectives, Program Goals and Plan

September 25, 1981

METRO-NORTH

SPECIFIC CAPITAL PROJECT OBJECTIVES AND PROGRAM GOALS

MAINTAIN A RELIABLE OPERATION

Provide additional seating for passengers through purchase of new cars: The objective of this program is to provide comfortable and reliable equipment for passengers to insure safe on-time arrivals and departures. Toward this end, the standard of providing seats for passengers with certain amenities such as heat, air conditioning and lighting has been established. At present many commuters are forced to stand. There has been a steady increase in ridership without a corresponding increase in car fleet. In the past four years ridership on the Hudson and Harlem Divisions has increased by more than 16 per cent. New Haven ridership has increased by 20 per cent during this period. Purchasing 142 new M-3 cars, 44 new M-2 cars, rehabilitating 24 4400 series cars and providing head end power in seven FL-9 locomotives is the goal of this program, which will satisfy the standard through 1986. Adding these cars to the present fleet will provide an adequate number of seats for passengers in the morning rush hour and will allow a 15% shop margin for essential maintenance and overhaul. The introduction of M-1 and M-3 equipment on the Upper Harlem Line will further enhance the reliability and comfort of this service, which is presently operated with locomotive and coach equipment.

The increased age of the present equipment has resulted in more equipment failures with fewer cars available for service.

An order has been placed with the Budd Company for the purchase of 60 M-3a cars. One car of each "married pair" is to be equipped with two "tie-down" positions for wheel chairs and also be provided with a portable ramp to bridge the gap between the car and platforms. Under this program, it is the Authority's intention to exercise the option in the original bid package and purchase an additional 82 cars. One car of each pair of the cars to be ordered as a part of this Five Year Plan will also be equipped with two wheelchair positions.

Delivery of the original order of M-3a cars for Metro-North is expected to begin in the fourth quarter of 1982 starting with four cars in October and increasing to a regular delivery of 20 cars per month in January 1983. The cars to be obtained for Metro-North as a result of the new order made possible in the 5 year program, will start to arrive in early 1984 with delivery complete by midsummer 1984.

An order has been placed with the Budd Company for the purchase of ten (10) SPV-2000 self-propelled diesel rail cars. These cars will replace the majority of the aging RDC fleet now in use on the Upper Hudson Line and the Brewster to Dover Plains portion of the Upper Harlem Line. The addition of the 108-seat SPV-2000 cars will provide seats for current standees and alleviate problems experienced in procuring parts for and maintaining the drive systems of the 30-year old RDC cars.

Delivery of the SPV-2000 cars to Metro-North is expected to begin in the third quarter of 1981 and be complete in the fourth quarter of 1981.

Specifications for M-2 electric passenger cars for use on the New Haven Line will be prepared in conjunction with the Connecticut Department of Transportation. It is anticipated that similar delivery will begin late 1984 with completion by mid 1985.

Forty-four M-2 cars will be purchased for the New Haven Line service. This purchase represents the MTA's portion of the total 110 cars needed. The M-2s will be compatible with the present equipment.

Provide additional seating and comfort for passengers by rebuilding retired cars: Twenty-four of the presently stored 4400 series electric cars will be rebuilt for diesel hauled service to improve and generally upgrade the level of service and commodiousness provided to passengers traveling to/from the Upper Hudson. Seven FL-9 units will also be specially equipped for use with the rebuilt cars.

The U.S. Environmental Protection Agency Rule 40 CFR. part 761, has mandated that the transformer cooling fluid PCB is a dangerous and toxic substance and as such should be removed from all locations where it may have an effect on human life. The Authority must replace all the M-2 Electric car Transformers to meet the requirements of that U.S. EPA ruling.

The Authority has applied for a Waiver to Postpone in this matter which may delay the need to perform this work. If this waiver is received, the funding will be applied entirely or in part to the overhaul of the MU Electric cars. These are basically sound cars which can provide additional years of good service if steps are taken to completely overhaul them.

Modernize and/or construct new car maintenance facilities: Modern shops are essential for the maintenance of reliable rolling stock. In order to provide essential maintenance in an efficient manner adequate space, materials, tools and manpower must be available. This program will provide for modernization of the

Harmon Shop, new or expanded shops at North White Plains, Brewster, Poughkeepsie and Grand Central Terminal. These facilities will be built to standards established for shops constructed on new transit properties or recently rehabilitated on existing properties. The new or expanded shop facilities will help to reduce the shop margin for cars down from the present unacceptable level of 33 percent to an acceptable level of 15 percent, will substantially contribute to reducing the average car shortage of 50 cars per day and the 5,657 train delays per year due to equipment failures. In addition, new shops at Poughkeepsie and Brewster will reduce the movement of empty equipment and eliminate unnecessary crew cost.

With the addition of new cars to the rolling stock fleet, there will be an added strain on the existing equipment maintenance facilties which are not adequate to maintain the present fleet.

A major part of this program consists of modernizing and upgrading shop facilities at Harmon. Metro-North shop facilities are of 1890 vintage and are inadequate to maintain the present electric and diesel fleets. Design of the new shop facilities will soon be underway.

The construction schedule for the proposed Harmon Shop improvements consists of two phases. Phase I involves upgrading and modernizing the main shop. Specific areas for improvement include the inspection and running repair area, the main service and repair area, office and comfort facilities, support shop facilities including air brake, electric, machine, wheel, truck, upholstery, new carpenter, and buildings and bridges shops and a blowing shed. This work is scheduled for completion in mid-1983.

Phase II of the Harmon Shop improvements consists of the construction of new car washing facilities and additional mechanical, electrical and service area improvements. This work is also scheduled for completion in 1983, approximately three months after Phase I is complete. State 1979 Bond funds provide $10M of the total cost of $20M. This program will complete its funding.

In addition to the major renovation that is required at Harmon Shop, a new electric car shop is required at Brewster to perform running maintenance on cars stored at that terminal. This facility will consolidate all of the various functions at different locations in the area. This facility will largely eliminate the necessity to deadhead shopped cars to and from Harmon, thus reducing operating costs and increasing car availability.

In order to improve equipment maintenance efforts, the present facilities at North White Plains, Grand Central Terminal and/or Poughkeepsie will be upgraded. The intensive use to which cars are subjected and the need to provide the maximum number of cars

for service each day dictates a high caliber, efficient maintenance program.

Maintenance of Way facilities should provide adequate offices, workshops and storage areas to enable employees to work safely and efficiently. Without proper facilities, Maintenance of Way crews cannot operate effectively, resulting in increased maintenance costs. Basic standards for these shop facilities have been developed. Many existing facilities consist of trailers, old box cars and temporary buildings, all of which are substandard. The goal of this program is to make improvements which will achieve these basic standards.

Specific improvements to be made under this program will include new facilities at Mott Haven and North White Plains. Without proper facilities, maintenance crews cannot operate efficiently, resulting in great costs for maintenance efforts. The construction of facilities at North White Plains and Mott Haven will provide sufficient facilities for the maintenance forces while serving to increase efficiency and reduce operating costs.

ENSURE LONG-TERM SURVIVAL AND SAFE, RELIABLE OPERATIONS

Modernize, then maintain a replacement cycle for system components: Past trends of allowing the existing system to deteriorate must be reversed. We have to make available the funds necessary to modernize and maintain the commuter rail system's vital components in a state of good repair.

A reliable source of electrical power is essential for the operation of the railroad. An up-to-date, modern power system with adequate capacity to assure a reliable operation is critical for continuation of service. This program will provide for the replacement of rotary converter and mercury arc rectification systems, built as early as 1912, with approximately 30 new substations. The substations will be remotely controlled resulting in the more efficient use of manpower. In addition, most 70-pound third rail will be replaced with high conductivity 150-pound rail. The remainder of the 70-pound rail will be replaced under a future program.

On the New Haven Line, interim repairs will be made to the Cos Cob power plant and at the West Farms substation. These repairs are essential to maintain service, until the new power system is made operational in 1986. Recent failures at both Cos Cob and West Farms have resulted in serious delays to and stoppages of daily service.

At the present time, approximately 210 track miles of the Harlem and Hudson Line are electrified and rely on substations to convert commercial power to power that can be used for our electric car fleet.

Almost all of the substations on the Harlem and Hudson Line are obsolete and in urgent need of replacement. The majority of these substations were placed in service prior to 1925 and utilize large rotary converters. These rotary converters have not been manufactured in over 50 years. A small number of substations were constructed in the 1940s, utilizing mercury arc rectifiers. These units have also reached the end of their economic lives and are prone to vacuum and coolant leaks.

Engineering for the proposed substations will be completed as a part of this program. In addition, approximately 30 new substations will be constructed using solid-state equipment. Also, all existing third rail (70 lb./ yd.) which has not been produced since the 1950s and whose low conductivity affects the proper operation of the equipment and air conditioning, must be replaced with the new standard 150 lb./yd. rail.

It will be necessary to make some improvements to the Cos Cob power house because of the longer than anticipated implementation time for the New Haven Line electric traction modernization program. This program will include those modifications necesary to insure continued operation of the Cos Cob plant as an interim measure until the modernization program is completed.

Installation of CWR was completed between Harmon and Manitou under the first phase of a major track upgrading program undertaken by New York State DOT. To help complete the program, funding is included herein for the installation of approximately 58 miles of 132#RE rail, turnouts and other track materials which were purchased by NYSDOT.

This will complete the welded rail on the Hudson Division between MP46 and MP75, thereby releasing additional rail for use on the Upper Harlem Line.

Interlockings, which are made up of a series of switches, are essential for flexibility and reliabie train service. These interlockings affect the routing of all trains operating from yards over main line tracks to stations. Under this program, the four-track Hudson line between Spuyten Duyvil and Harmon will be converted to a three-track, reversible direction railroad. This will not only increase the operating flexibility of the service but will save the cost of maintaining one track and the various signals and switches which support it.

Under these improvements, all major interlockings will be upgraded, with some relocated, to permit higher diverging speeds and slightly reduce travel times. Under a previous phase of this program, 32 of the required turnouts have been purchased. Partial funding for this program is available from a federal grant of "pre-1982" funding.

Rehabilitation and the revamping of other main interlockings, such as at Harmon, North White Plains and Brewster North will improve the efficiency of yard operations.

Miscellaneous interlocking improvements are necessary at several locations. Under this program, Harmon Interlocking will be reconstructed to permit movement of trains directly from the yard or shop areas to the station platforms eliminating the need for cumbersome and slow yard moves. Major improvements will be made at Brewster, North White Plains, Mott Haven, Shell and Pike Interlockings to improve operating flexibility and reduce conflicts during train movement.

Bridge and Tunnels must be maintained in order to allow for the safe and reliable operation of trains. The condition of structures in the Metropolitan Region is, as a general rule, below an acceptable standard of maintenance due to lack of sufficient resources. All structures are inspected annually and are considered safe but continue to deteriorate due to lack of maintenance, resulting in major capital expenditures for rehabilitation. Funds for this program will be used for repairs, renewals, and rehabilitation of those bridges and tunnels which are in an advance state of deterioration. Other structures will be included in future programs.

The miscellaneous bridge and tunnel improvement program is designed to eliminate many years of deferred maintenance. This program will include the continued upgrading of the Park Avenue Viaduct including strengthening of columns and girders, waterproofing and painting.

The Park Avenue Tunnel will be the subject of an engineering study to determine the nature and extent of modernization required under future programs.

Yard facilities should provide efficient and reliable storage, servicing and movement of trains from yard tracks to terminal stations. While there is no standard yard arrangement, the facilities should be arranged to facilitate a minimum of car movements in addition to minimizing train movements, the track structure should be constructed to insure reliability of train movements. More than 50 derailments occurred last year in Metropolitan Region yards due to poor trackage.

The goal of this program is to improve yards at Harmon, North White Plains and Brewster to increase reliability and efficiency of movement at these three locations and to provide storage space for additional equipment. The scope of this program will not accomplish a total rehabilitation, but will substantially reduce major yard problems.

As ridership and car fleet size continue to grow, the facilities to accommodate the fleet must be addressed. Yard improvements at all locations, especially Harmon, Poughkeepsie, North White Plains and Brewster are necessary if we are to provide the increasing levels of ridership forecast for the future.

This item may also include such items as improved drainage and modernization of support facilities.

Due to the advanced age of the catenary system on the New Haven Line, it is necessary to study the existing condition of the catenary components and make recommendations for future improvements.

Upgrade system components providing additional operating flexibility: The upgrading of signal components on the Conrail commuter facilities will permit more flexible train operation while upgrading obsolete equipment.

A modern signal system is essential in order to provide safe, reliable train service throughout the Metropolitan Region. While the present system is safe, it has a high maintenance cost. Some 1,100 train delays due directly to signal failure occurred last year. The most reliable, trouble free system is one incorporating cab signalling with overspeed control and centralized traffic control on all main line tracks. This program will provide this type of system from Mott Haven to Brewster North and from Mott Haven to Croton-Harmon. New York State Department of Transportation under their high speed rail improvement project, will install similar signalling between Croton-Harmon and Poughkeepsie. The same signalling system is being installed on the New Haven Line under a separate program. Funds for completion of this system, primarily between Mott Haven and Grand Central Terminal, will be requested in future programs.

The optimum form of signalling for heavily trafficked commuter rail operation consists of centralized traffic control with cab signalling and overspeed protection. This form of signalling provides for control of trains on any track in either direction, with signal information presented in the cab of the train. As part of this program, cab signalling will be installed on all tracks from Mott Haven to Croton-Harmon and Brewster leaving only the segment between Grand Central Terminal and Mott Haven to be completed in the post-1986 period.

Engineering design work is presently underway for the cab signalling improvements on the Hudson-Harlem Lines. Some materials have already been ordered for portions of this program with funding from other sources. Due to the technical complexity of some of the components which must be manufactured and the long lead times for delivery, installation will probably not begin until 1983. All phases of the program will not be complete until some time in 1986.

STATION IMPROVEMENTS

Passenger stations should provide a convenient and safe means of gaining access to passenger trains. In order to insure safety and convenience, standards for station facilities such as buildings, platforms, lighting, signage, communications, canopies and shelters have been developed. The construction of new high level platforms and related station facilities at 12 major station locations necessitated by the electrification of the Upper Harlem Line, is part of this program. These stations will now meet the standards established on other portions of the line. As an example, the construction of high level platforms will speed passenger loading and unloading through high level quarter-point doors on M-1 and M-3 equipment, thereby reducing station dwell time, avoiding delays, and improving passengers convenience.

Modernize stations and terminal facilities: Station improvements will be made in order to improve system environment and safety for commuters. This program includes various improvements at individual stations. The general types of improvements may include lighting and signs, shelter and waiting room improvements, ramps, general painting and repairs and platform extensions.

Construction of high level platforms on the Upper Harlem Line will commence during 1982. The car floor level platforms must be complete before the modern electric M-1a and M-3a passenger cars can serve the area as a part of the Upper Harlem electrification. It is presently estimated that design work will be done during the later part of 1981. The new high level platforms, which will be fully accessible to elderly and handicapped persons, will continue to be usable by commuters riding diesel hauled equipment.

INCREASE SYSTEM CAPACITY

Extend electrified passenger service: Extension of the electrified territory will result in more reliable, efficient and comfortable service. This program will provide electrification of 29 route miles between North White Plains and Brewster North on the Harlem Line. Specific improvements will include construction of nine electric power substations, installation of 150 lb./yd third rail and the necessary signal and power line installation. These improvements will permit the introduction of M-1 and M-3 electric car service, replacing the existing fleet of standard coaches, many of which are 30-40 years old and prone to frequent breakdowns. These improvements will result in a faster, more comfortable and reliable service.

The Upper Harlem electrification is now underway. Several of the larger material requirements are on order, including contact rail, spikes and bolts. Other material orders, including third rail insulators, power cables, cast end approaches, and substation apparatus are awaiting approval prior to award. This work has been progressed with funding from prior periods.

The schedule for construction will permit operation of electrified passenger trains to Brewster in the end of 1983.

Extension of electrification to Brewster will provide modern, efficient service to outlying areas of Westchester and Putnam Counties. Electrification will permit more modern commuter service to these areas. This segment of the program provides $10 million for utility costs which were not anticipated as part of the project budget.

METRO-NORTH PORT JERVIS SERVICE

In September 1973, MTA assumed financial responsibility for passenger service on the Port Jervis Line from Suffern to Port Jervis. MTA entered into a contract with New Jersey Department of Transportation to operate this service as an extension of its operation between Hoboken and Suffern. Prior to 1973, these trains received no subsidy and were operated with 50-year old coaches and 25-year old locomotives. MTA replaced the obsolete equipment with new push-pull trains provided through a lease agreement with New Jersey Department of Transportation. In 1978, MTA purchased eight coaches and one locomotive to add to the New Jersey equipment pool, thereby eliminating the lease charges. Pascack Valley Line stations in Rockland County have been serviced by the New Jersey push-pull trains since 1971. Ridership has increased significantly in Orange and Rockland Counties. MTA will provide 14 additional coaches and 2 locomotives, initially, through a lease arrangement with New Jersey Transit. MTA will assume this cost, estimated at $250,000 to $350,000 per year, on or about October 1, 1981. MTA has ordered six new coaches which are expected in early 1983, purchased with funds from the 1974 Bond Issue. Delivery of these six coaches into the New Jersey equipment pool will reduce the lease payments accordingly. Estensive track upgrading from the state line to Spring Valley has also been financed by the State of New Jersey.

As part of its statewide rail freight upgrading program, funded by the 1979 Bond Issue, New York State Department of Transportation is rebuilding the track and upgrading the signal system from Suffern to Port Jervis. As a result, the passenger service will be shifted from the Main Line to the Graham Line. New stations and parking lots will be constructed at Harriman, New Windsor, Campbell Hall, and Middletown. Track and signal work is nearly completed and property acquisition for the parking areas is underway at this time.

Station and parking facilities at Spring Valley are undergoing a major improvement at this time. A State Department of Transportation project to enlarge and repave the parking lots, bus loading area, and station platform is nearly complete. MTA is preparing designs for the total rehabilitation of the station building, including a new ticket office, waiting room for both rail and bus users, police booth, crew room for bus drivers, and office space for various Rockland County agencies. Reconstruction of the station will commence by the end of the year.

In the Five Year Capital Program, funds have been allocated for station improvements west of the Hudson. These funds will be used to improve platforms, lighting, shelters, signage and parking facilities at those Orange and Rockland stations (Pearl River, Nanuet, Sloatsburg, Tuxedo, Otisville, and Port Jervis) not undergoing improvements through other capital programs.

UNSPECIFIED EMERGENCY MISCELLANEOUS WORK

Emergency Repair Programs: This item is provided in the event an emergency repair or replacement of any type of system components is required. This could include structural, track, signal, electric traction or rolling stock.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: CARS

CATEGORY NO.: M-1

GOAL: Provide additional seating for passengers through the purchase of new cars.

5 YEAR COST: $277.5M

POLICY OBJECTIVE: Improve the comfort, convenience and dependability provided to passengers by providing additional rolling stock.

ELEMENT DESCRIPTION: There has been a steady increase in ridership without a corresponding increase in car fleet. In the past four years ridership on the Hudson and Harlem Divisions has increased by more than 16 per cent. New Haven ridership has increased by 20 per cent.

The increased age of the present equipment has resulted in greater number of equipment failures with fewer cars available for service. This program provides for 82 new M-3a cars for MTA's Conrail service. As part of the Harlem and Hudson fleet, the new M-3as will be used in conjunction with the extension of electrification on the Upper Harlem Line. It is anticipated that the extended electrified service will stimulate further growth in ridership.

An order has been placed with the Budd Company for the purchase of 60 M-3a cars. Under this program, it is the Authority's intention to exercise the option in the original bid package and purchase an additional 82 cars. Delivery of the initial order of M-3a cars to Conrail is expected to begin in last quarter of 1982. The cars to be ordered as a part of this program will begin to arrive in early 1984 with final delivery in mid-1984.

One car of each "married-pair" of cars of both the initial 60 car order and of the additional 82 car order will be equipped with two "tie-down" positions for wheelchairs and a portable ramp for bridging the gap between the car and the platform.

An additional order has been placed with the Budd Company for the purchase of ten (10) SPV-2000 self-propelled diesel rail cars. These cars will replace the majority of the aging RDC fleet now in use on the Upper Hudson Line and the Brewster to Dover Plains portion of the Upper Harlem Line. The addition of the 108-seat SPV-2000 cars will provide seats for current standees and alleviate problems experienced in procuring parts for and maintaining the drive systems of the 30-year old RDC cars.

Delivery of the SPV-2000 cars to Conrail is expected to begin in the third quarter of 1981 and be complete in the fourth quarter of 1981.

Forty-four M-2 cars will be purchased for the New Haven Line service. This purchase represents the MTA's portion of the total 110 cars needed. The M-2s will be compatible with the present equipment.

Extensive work must also be performed on the older equipment. For service on the Hudson Line north of Croton-Harmon, 24 of the former New Haven Line 4400s will be remanufactured to a "like-new" condition at considerably less cost than new cars for locomotive hauled push-pull service from Poughkeepsie to Grand Central. Six of these multiple unit cars will be remanufactured as cab cars. This will enable operation of the locomotive from the opposite end of the train, elininating the need to switch engines. the remaining 18 coaches will be completely rebuilt as standard coaches.

In conjunction with this program it is necessary to modify the seven FL9 locomotives which were recently rebuilt with head-end power (HEP) supply apparatus. These seven locomotives will be used with the 4400s.

U.S. Environmental Protection Agency Rule 40 CFR, part 761, has mandated that the transformer cooling fluid PCB is a dangerous and toxic substance and as such should be removed from all locations where it may have an effect on human life. The Authority must replace all the M-2 Electric car transformers to meet the requirements of that EPA ruling.

The Authority has applied for a waiver in this matter which may postpone the need to perform this work. If this waiver is received, the funding will be applied entirely or in part to the overhaul of the MU Electric cars. These are basically sound cars which can provide additional years of good service if steps are taken to completely overhaul them.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
M-1a	Purchase of 142 new M-3a cars, 10 SPV cars	A	176.5	-	-	-	-	176.5	(1)(2)
M-1b	44 new M-2 Electric Passenger Cars	A	-	71.6	-	-	-	71.6	
M-1c	Rebuild 24-4400 series cars, equip 7 FL9 locomotives with Head End Power and Replacement of M-2 Transformers or rebuild MU Cars	A	17.4	12	-	-	-	29.4	

(1) Includes carry forward for purchase of 60 M-3 cars ordered in 1981 at a cost of $66.5M.
(2) Includes carry forward for purchase of 10 SPV cars ordered in 1981 at a cost of $12M.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: PASSENGER STATIONS CATEGORY NO.: M-2

GOAL: Modernize stations and terminal facilities. 5 YEAR COST: $23.3M

POLICY OBJECTIVE: Station improvements will be made in order to improve system environment and safety for commuters.

ELEMENT DESCRIPTION: This program includes high level platforms on the Upper Harlem Line and various minor improvements at individual stations. These general types of improvements may include lighting and signs, shelter and waiting room improvements, ramps, general painting and repairs and platform extensions.

The specific station improvements presently identified include a new station at North White Plains to replace the temporary trailer, replacement of glazing materials in existing shelters and overpasses with mar resistant material and handicapped access improvements at several major stations. These include overpasses at Rye, New Rochelle, Mt. Vernon, North White Plains, Crestwood and Harmon; shelters at some 32 different locations and handicapped facilities at such locations as Yonkers, Tarrytown, Harmon, and Fordham.

In addition, improvements to parking, platforms, shelters and station lighting will be made at various stations on the Port Jervis and Pascack Valley Lines. The end result of these improvements will be the provision of a safer, more comfortable environment for the riders using these stations.

	ELEMENT		COMMITMENTS PER CALENDAR YEAR						
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
M-2	High Level Platform on Upper Harlem Line and Misc. Station Improvements.	A	18.5	-	1.6	.5	2.7	23.3	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: LINE STRUCTURES CATEGORY NO.: M-3

GOAL: Modernize then maintain a replacement cycle for system components.

5 YEAR COST: $29.2M

POLICY OBJECTIVE: Upgrade system components to improve reliability and dependability.

ELEMENT DESCRIPTION: Installation of CWR was completed between Harmon and Manitou under the first phase of a major track upgrading program undertaken by New York State DOT. To help complete the program, funding is included herein for the installation of approximately 58 miles of 132#RE rail, turnouts and other track materials which were purchased by NYSDOT. Partial funding is from "pre-1982" funds.

This will complete the welded rail on the Hudson Division between MP46 and MP75, thereby releasing additional rail for use on the Upper Harlem Line.

This program will also include interlocking improvements between Spuyten Duyvil and Croton River Bridge which result in a three track reverse traffic railroad on the Hudson Line. Under these improvements, all major interlockings will be upgraded with some relocated to permit higher diverging speeds and slightly reduce travel times. Under a previous phase of this program 32 of the required turnouts have been purchased. Partial funding for this program is available from a federal grant of "pre-1982" funding.

Miscellaneous interlocking improvements are necessary at several locations. Under this program, Harmon Interlocking will be reconstructed to permit movement of trains directly from the yard or shop areas to the station platforms eliminating the need for cumbersome and slow yard moves. Major improvements will be made at Brewster, North White Plains, Mott Haven, Shell and Pike Interlockings to improve operating flexibility and reduce conflicts during train movement.

The miscellaneous bridge and tunnel improvement program is designed to eliminate many years of deferred maintenance. This program could include the continuing upgrade of the Park Avenue Viaduct including strengthening of columns and girders, waterproofing and painting. Work on most of the Regions bridges in the form of floor beams, foundation work and structural steel should be studied.

The Park Avenue Tunnel will be the subject of an engineering study to determine the nature and extent of modernization required. This study will be the framework upon which a major rehabilitation program will be developed for future implementation.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
M-3	Interlocking Improvements, Harmon to Poughkeepsie Track Improvements, Bridge and Tunnel Rehabilitation	A	4	3	9.3	5.5	7.4	29.2	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SIGNALS CATEGORY NO.: M-4

GOAL: Upgrade system components, providing additional operating flexibility. 5 YEAR COST: $74M

POLICY OBJECTIVE: The upgrading of signal components on the Conrail commuter facilities will permit more flexible train operation while upgrading obsolete equipment.

ELEMENT DESCRIPTION: The optimum form of signalling for heavily trafficked commuter rail operation consists of centralized traffic control with cab signalling and overspeed protection. This form of signalling provides control of trains on any track in either direction, with signal information presented in the cab of the train. As part of this program, the installation of cab signalling on all tracks from Mott Haven to Croton-Harmon and Brewster will be completed.

With the completion of this program, the entire signal system will have been rehabilitated and modernized with the exception of the segment between Grand Central Terminal and Mott Haven which will be done in the post-1986 period.

	ELEMENT		COMMITMENTS PER CALENDAR YEAR					
NO.	DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
M-4	Hudson Harlem Cab Signalling	A	-	10	20	22	22	74	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: POWER

CATEGORY NO.: M-5

GOAL: Modernize then maintain a replacement cycle for system components.

5 YEAR COST: $193.5M

POLICY OBJECTIVE: Past trends of allowing the existing system to deteriorate must be reversed. We have to make available the funds necessary to modernize and maintain the commuter rail system's vital components in a state of good repair.

ELEMENT DESCRIPTION: At the present time, approximately 210 miles of the Harlem and Hudson Line are electrified. Almost all of the substations on the Harlem and Hudson Line are obsolete and in urgent need of replacement. The great majority of these substations were placed in service prior to 1925 and utilize large rotary converters. These rotary converters have not been manufactured in over 50 years. A small number of substations were constructed in the 1940s utilizing mercury arc rectifiers. These units have also reached the end of their economic lives and are prone to vacuum and coolant leaks. The present facilities are in a state which could potentially lead to a situation similar to that caused by the ailing Cos Cob plant on the New Haven Line.

All existing substations will be replaced using solid-state apparatus. In addition, all existing third rail (70 lb/yd), which has not been produced since the 1950s and whose low conductivity affects the proper operation of equipment and air conditioning, must be replaced with new standard 150 lb/yd. rail.

Due to the longer than anticipated implementation time for the New Haven Line electric traction modernization program, it will be necessary to make some improvements to the Cos Cob power house. This program will include those modifications necesary to insure continued operation of the Cos Cob plant as an interim measure until the modernization program is completed.

It is necessary to study the existing condition of catenary components and make recommendations for future improvements. Various alternatives will be examined which will not only modernize the system but also reduce operating and maintenance costs.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
M-5	Hudson/Harlem Substation and Third Rail Modernization, Cos Cob Power Plant Improvements, and Misc. Electric Traction	A	7.5	20	45.5	55.5	65	193.5	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

September 25, 1981

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: SHOPS/YARDS — CATEGORY NO.: M-6

GOAL: Modernize and/or construct new car maintenance and yard facilities. — 5 YEAR COST: $35.2M

POLICY OBJECTIVE: Include maintenance and yard facilities so that the present and future car fleets can be properly maintained and be made available.

ELEMENT DESCRIPTION: This program consists of modernizing and upgrading shop facilities at Harmon. Conrail shop facilities are of the 1890 vintage and are inadequate to maintain the present electric and diesel fleets. Design of the new shop facilities will soon be underway.

The construction schedule for Harmon Shop Improvements consists of two phases. Phase I consists of upgrading and modernizing several areas of the main shop and construction of new B&B and carpenter shops and a blowing shed. This work is scheduled for completion in mid-1983.

Phase II consists of the construction of car washing facilities and mechanical, electrical and service area improvements. This work is also scheduled for completion in 1983 approximately three months after Phase I is complete.

In addition to the major renovation that is required at Harmon Shop, a new electric car shop is required at Brewster to perform running maintenance on cars stored at that terminal. This facility will consolidate all of the various functions at different locations in the area. This facility will largely eliminate the necessity to deadhead shopped cars to Harmon, thus reducing operating costs and increasing car availability.

In order to improve equipment maintenance efforts, the present facilities at North White Plains, Grand Central Terminal and/or Poughkeepsie will be upgraded. The intensive use to which cars are subjected and the need to provide the maximum number of cars for service each day dictates a high caliber, efficient maintenance program.

Current facilities for Maintenance of Way, Signal and Electric Traction forces include trailers, old box cars, temporary facilities owned by Amtrak, and other substandard headquarters. Without proper facilities, maintenance crews cannot operate efficiently, resulting in increased costs for maintenance efforts. The construction of facilities at North White Plains and Mott Haven will provide sufficient facilities for the maintenance forces while serving to increase efficiency and reduce operating costs.

As ridership and car fleet size continue to grow, the facilities to accomodate this fleet must be addressed. Yard improvements at all locations, especially Harmon, Poughkeepsie, North White Plains and Brewster are necessary if we are to provide the increasing levels of train service forecast for the future.

It may be necessary to acquire additional property adjacent to the present Harmon facility.

This item may also include such items as improved drainage and modernization of support facilities.

NO.	ELEMENT DESCRIPTION	CLASS	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
M-6a	Miscellaneous electric car Shop Work at Brewster, NWP, GCT and/or Poughkeepsie. New Maintenance of Way facilities at Mott Haven and North White Plains, and miscellaneous yard improvements	A	2.2	3	7	5	8	25.2	
M-6b	Harmon Shop Improvements	B	10	-	-	-	-	10	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: ELECTRIFICATION   CATEGORY NO.: M-7

GOAL: Extend electrified passenger service.   5 YEAR COST: $10M

POLICY OBJECTIVE: Extension of electrification to Brewster will provide modern, efficient service to outlying areas of Westchester and Putnam counties. Electrification may permit more modern commuter service to these areas.

ELEMENT DESCRIPTION: This project consists of the electrification of the 28 route miles of railroad between North White Plains and Brewster on the Harlem Lines. The improvements consist of the construction of nine electric power substations, installation of 150 lb/yd. current-carrying third rail and the necessary signal and power line construction.

This "project" consists of $10 million for utility costs associated with the Upper Harlem electrification that were not anticipated in the original estimate.

NO.	ELEMENT DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
			COMMITMENTS PER CALENDAR YEAR						
M-7	Upper Harlem Electrification	B	10	-	-	-	-	10	(1)

(1) Excludes "pre-1982" funds.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH

FIVE YEAR CAPITAL PROGRAM

DETAIL

CATEGORY: MISCELLANEOUS CATEGORY NO.: M-8

GOAL: Emergency Repair Programs. 5 YEAR COST: $41.3M

POLICY OBJECTIVE: Make funds available for the emergency repair or replacement of any type of system components.

ELEMENT DESCRIPTION: This work could include structural, track, signal, electric traction or rolling stock.

			COMMITMENTS PER CALENDAR YEAR						
NO.	ELEMENT DESCRIPTION	CLASS	1982	1983	1984	1985	1986	TOTAL	NOTE
M-8	Misc. Emergency Repairs	A	5	2	10.5	7	16.8	41.3	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to refl[illegible] inflation.

SECTION II B 5

FINANCING PLAN

LIRR/METRO-NORTH

FINANCING PLAN

LIRR/METRO-NORTH

As part of the requirements outlined for capital program plans in the Transportation Systems Assistance & Financing Act of 1981, each plan must "set forth an estimate of the amount of capital funding required each year and the expected sources of such funding." The preceding section has established the capital funding requirements, by year of program commitment, for the commuter railroads. The table below identifies the expected sources of funding for the elements to be committed for each year's capital program. It should be noted, however, that the funds that will support the projects for any given year will not necessarily be raised in that same year. In particular, the revenue bonds identified as the probable source for car financing and refinancing are shown as supporting commitments in the early years of the program. However, based on delivery schedules, these bonds will be sold in later years. Part III-B of this report, containing supporting materials on financing, explains the strategy and timing of raising capital to undertake the plan.

LIRR/METRO-NORTH

Financing Plan by Year of Commitment
($ in millions)

	1982*	1983	1984	1985	1986	TOTAL
Program Commitments	$ 544	$ 209	$ 215	$ 195	$ 204	$1,367
Expected Funding Source** Federal	30	30	33	36	40	169
State	85	59	-	-	-	144
TBTA Bonds	-	-	17	159	164	340
ASC Bonds	-	49	165	-	-	214
Revenue Bonds	343	57	-	-	-	400
Lessor Equity	86	14	-	-	-	100
TOTAL	$ 544	$ 209	$ 215	$ 195	$ 204	$1,367

*Includes potential rolling stock refinancing.
**Prior to and concurrent with permanent financing by any of these means, preliminary funding through short-term borrowing or acceptance financing or other temporary funding mechanisms may be obtained. Vendor terms for payment for particular capital elements or particular components of capital elements constituting transit projects may be sufficiently favorable to avoid the necessity for or to represent an attractive alternative to financing the cost thereof through bonds. If favorable extended term vendor financing is available, the amount of revenue bonds included in the above table would be reduced by the amount of such vendor obligations.

SECTION III

SUPPLEMENTARY MATERIAL IN SUPPORT OF THE PROGRAM PLAN

SECTION III

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SECTION III A

ADDITIONAL ANALYSIS AND DISCUSSION
OF SELECTED PORTIONS OF THE PLAN

TRANSIT AUTHORITY CAR FLEET STRATEGY

At the present time the Authority has a fleet of 6,311 rapid transit cars which are assigned to the IRT system and BMT/IND system. Because of physical restraints of the existing subway structure, the cars are not inter-changeable between the two systems. Generally, IRT trains are made up of 10 cars for a train length of 515 feet with each car being 9 feet wide. The BMT/IND trains are comprised of either 8-75′ cars or 10′-60′ cars for a train length of 600 feet with each car being 10 feet wide. A listing of the current car fleet is shown on Table 1.

In developing a strategy for the renewing of the rapid transit car fleet two obvious choices are apparent; one is to purchase new cars and retire older cars, and the second is to rebuild the existing cars. Because of the magnitude of the need to replace overaged and unreliable rolling stock, this particular element of the Authority′s overall Five Year Capital Program has received special emphasis.

The basic goal is to provide safe, reliable and commodious service through fleet modernization. In determining how best to achieve that goal through a combination of new car purchases and overhaul of existing car fleet, the Authority first examined the car retirement issue.

First the objective could be to retire and replace vehicles when they reach the end of their anticipated useful life, which historically has been identified as 35 years. Alternatively, the objective of maintaining an average fleet age of half the anticipated useful life would be appropriate. With an assumed life of 35 years, this objective could be stated as an average fleet age of 17.5 years.

One difficulty in using age as the sole basis for defining objectives is the fact that some older cars are more reliable than some series of newer cars. Another difficulty is the fact that older series of cars inevitably experience attrition in numbers throughout their life as a result of accidents and maintenance conditions which require their premature retirement. A further problem involves the questionable validity of the assumption that subway cars have a useful life of 35 years.

In a 1976 study conducted for the Transit Authority by Wyer Dick and Company, the following points were made:

It is generally assumed that effective life indicates the age when the car should be retired, reflecting the impact of various economic and intangible factors. However, none of those have been qualified in the arbitrary assignment of 35 years as the effective life. The precise origin of the 35 year life is lost in history. There is reason to believe that the 35 year life was originally related to the period of bonded indebtedness incurred when borrowing money for the purchase of new transit cars. It is fairly certain, however, that there was never any "engineered" life of precisely 35 years built into the vehicles.

The report identifies the wide variance in the assumed life of rapid transit cars by other systems. The spectrum extends from 25 years (Chicago Transit Authority) to 45 years (Stockholm, Sweden). More recently we have learned that current Japanese practice for replacing standard rail cars assumes a 20 year useful life.

The Wyer Dick report also observed that various series of NYCTA cars purchased between 1904 and 1940 were retired at ages ranging from 25 years (the 1938 W-F series) to 46 years (the 1904 HV series) with average retirement at about 39 years for all pre-World War II series. It should further be noted that older cars were kept in service during World War II because of high transit ridership and because the war effort precluded the manufacture of domestic transportation vehicles. But for the war, car retirements might have occurred on an earlier schedule.

Post-war car purchases occurred in several distinct patterns. From 1948 through 1950, car purchases were essentially used to expand the fleet and relieve overcrowing rather than to retire older cars. A hiatus in car procurement occurred from 1951 through 1954 during the Korean War years. From 1955 to 1969, new car purchases for the replacement of older vehicles occurred on a schedule which implies a 20 year useful life assumption. Purchases during the decade of the 1970's were sporadic, presumably reflecting the fiscal problems of New York City.

In light of these facts, the objectives of the fleet modernization program cannot be defined solely on the basis of age -- either average age or maximum useful life. Rather, one must examine the reliability, efficiency, and commodiousness of each car series in making the decision as to when retirement occurs. Undoubtedly, a continuing, comprehensive overhaul program can postpone retirement dates beyond those which would otherwise

be required. On the other hand, there has been no such overhaul program within the Transit Authority during the life of the car series which now comprise the fleet. It is unclear how effectively the future implementation of overhaul programs on historically undermaintained cars which are now 15, 20 or 30 years old will extend their useful life. Rather than speculating about future useful life extensions, it is more relevant to project and then monitor the effectiveness of overhaul in increasing the present-day reliability of cars now operating on the system.

In evaluating car reliability, the Authority uses the term Mean Distance Between Failures. A failure is any interruption of service due to car equipment failure, including the various car subsystems. In analyzing failures over the past 12 months, the following is a breakdown as to source:

Item	% of Failures
Traction Motors and Other Electrical Failures	45
Door Defects	30
Braking System	16
All Others	9

The best professional judgment available to the Authority on the effects of overhauls would appear to indicate that minor barn overhauls, "D" overhauls, may increase the reliability of cars, measured as the car equipment mean distance between failure or MDBF by 10% of the pre-existing MDBF, while major shop overhauls may increase the MDBF by 25% of the pre-existing figure. Certain special modifications or retrofits may increase the MDBF by even greater percentages in such cases as the correction of electrical subsystem problems on the R-44, or truck problems on the R-46. Individual estimates for expected improvement in MDBF must be made in such cases. In every case, however, it seems clear that MDBF will degrade as vehicles get older during periods between overhauls.

To ascertain the normal rate of MDBF degradation within the limitations of data available to the Transit Authority, two approaches were pursued. First, the MDBF for each car series during the past fiscal year was plotted as shown on Chart I. A decay curve was plotted through these points. It appears to

demonstrate that the rate of degradation in MDBF diminishes over time. If the curve is extended to a point which depicts an initial MDBF of 30,000 miles (as required in NYCTA specifications for the R-62 and R-68), a logical pattern emerges. Initially, MDBF degrades at a rate of about 10% a year. By the 10th year, the rate of degradation is reduced to about 8% a year. After 30 years, it diminishes to 3%. Also shown on Chart 1 is the probable effect of a continuing, comprehensive overhaul program with minor barn overhauls (increasing MDBF by 10%) at 4 to 4-1/2 year intervals, and major shop overhauls (increasing MDBF by 25%) at 8 to 9 year intervals. This overhaul schedule is consistent with the approach recommended by the Emerson Consultants in their 1980 report.

The second approach for evaluating the normal rate of degradation of MDBF involves the examination of rates of changes in MDBF during the past 10 years. Chart 2 depicts the fleet MDBF in each year from 1971 to 1981. It can be seen that the MDBF has been on a downward trend from its high point of 24,000 miles in 1971 to 6,700 miles in 1981. On the bottom of Chart 2 the annual rate of change in MDBF is depicted. Over the 10 year period, that rate of change has averaged -9.7%. During relatively normal years (from 1971 to 1974 and 1977 to 1978) the rate of degradation was in the 7% to 10% range. After the arrival of R-44 cars which were extraordinarily unreliable from the outset, the rate of degradation increased to 20%. This trend was reversed with the arrival of the R-46 cars during the period 1975 to 1977, until truck cracking caused acute difficulties with that car series. In the past few years, the rate of change in the MDBF has slipped constantly lower. The chart also shows that the only dramatic change in either the MDBF or the rate of change in the MDBF occurred during a period when reliable cars (the R-46 series) were replacing older and much less reliable cars. It is difficult to separate the contribution of deferred maintenance from the contribution of an aging fleet when addressing recent changes in the MDBF. Even if one were to assume a 50/50 split, it would nonetheless appear that an annual rate of degradation in MDBF on the order of 10% is realistic. Thus, if anything, the trend lines depicted on Chart 1 appear optimistic in light of the evidence shown on Chart 2.

During 1982, 747 subway cars will receive minor overhauls at the inspection barns. The MDBF of these cars should increase 10% above present levels. This program will continue at the same annual rate, 747 cars, during the Five Year Capital Program.

Augmenting this will be a major overhaul program for 574 cars which will be performed at the two main shops, 207th Street and Coney Island. This program will start in 1983 and will be continued. The MDBF of these cars are projected to increase 25% above present levels.

By 1984, it is assumed that the R-44 and R-46 series cars will be restored to the MDBF predicted on Chart 1 through modifications and retrofits. This will make a substantial improvement in fleet MDBF. Combining the results of these programs with the benefits to be derived with the procurement of 1,376 new cars wil permit the MDBF to rise to 15,000 by 1987. To put these program improvements in another perspective, the proposed car modernization program will bring reliability back to the level experienced in 1974-75, while a program without new car purchases will leave the subway system about where it was in 1980-81. Clearly, the retirement of 1,724 cars in series R-10 through R-22, and their replacement with 1,376 new R-62´s and R-68´s is the key to improving the reliability of subway service through the five year capital program.

There are further considerations with respect to the car modernization program. In the 1978 study of car maintenance by the Emerson Consultants, fleet size as well as the need for overhaul programs was examined. In the 1980 Emerson study, an approach to the car overhaul program was presented in substantial detail, along with some refinements of the 1978 estimates. The fleet demand observed by Emerson in 1978 and projected for 1983 is shown on Chart 3 along with actual data for 1981 and staff projections for 1982, 1983, 1985 and 1987. From this chart, it can be seen that the subway system is currently operating with a tighter margin then existed in 1978 insofar as transportation logistics and maintenance adjustment factors are concerned. On the other hand, cars held in barns for repairs and in shops for modifications and retrofits are substantially higher than predicted by the Emerson Consultants. This is a reflection of the R-44 and R-46 problems and the consequent need to reinstate R-10´s and R-16´s to full service. The chart depicts our plan for bringing maintenance demand into line with the Emerson recommendations for 1983, recognizing that shop and barn repairs will not go down substantially until the MDBF is improved through the car modernization program and the modification and retrofit of trouble prone series of cars. It is realistic to estimate the achievement of the Emerson report recommendations by 1987 if the proposed car moderniza-

tion program is adopted. In the absence of new car purchases, it is likely that the 1987 ratio of cars out of service for maintenance will be comparable to that projected for 1983 on chart 3.

Thus, the car modernization program, including the purchase of 1,376 new cars is the key to fleet efficiency, measured in terms of spare ratios. It is our projection that the fleet size can be reduced from 6,311 cars in 1981 to 5,963 cars by 1987 through the proposed combination of new car purchases and overhauls. The spare ratio can be reduced from 23% to 16.5% during that same period.

With regards to the cost of the new rapid transit cars, on July 15, 1981, the Transit Authority received bids from Nissho Iwai and Budd on R-62 subway cars for the IRT. Nissho Iwai was the apparent low bidder for the base quantity of cars to be purchased. The apparent low bid ranged from a unit price of $898,800 for the minimum base quantity of 225 cars to $893,900 for the maximum base quantity of 325 cars. The bid price is further subject to escalation through the time of materials purchase and delivery in accordance with formulae keyed to the pertinent federal indices and specified in detail in the contract documents. Extending the bid price to account for the aforesaid escalation and contingencies results in an estimated contract amount of $345 million for 325 R-62 subway cars for the IRT which includes spare parts and spare trucks.

The balance of the orders for new cars would be placed recognizing the capacity of the manufacturers and suppliers to meet the Authority's needs. On that basis, the Authority would order the 1,150 IRT cars in the near future and 226 BMT/IND cars in 1984. This would permit a delivery schedule whereby 130 cars would be delivered in 1983, 300 in 1984, 360 in 1985 and in 1986 and 226 in 1987.

Unit price estimates for the new cars have been based on the prices submitted by bidders for optional additional quantities of R-62's. Appropriate adjustments have been made for 75' cars. It should be noted that the option prices bid by Nissho Iwai were substantially higher than those bid by Budd. In re-estimating the unit prices of cars, Budd's option prices were used as a base point rather than Nissho Iwai's. We have been informed that Nissho Iwai built in a substantial amount for uncertainty in the international exchange rate when quoting prices on optional quantities. It is our belief that those

options should not be exercised with Nissho Iwai if the prices remain at an unacceptably high level. Thus, the more reasonable quotes of Budd, escalated in accordance with contract terms and proposed delivery schedules, are a more valid basis for cost projections. With all of the aforesaid adjustments, the purchase of 1,376 new subway cars during the five year program period is estimated to cost $1,749,000,000.

The recent enactment of federal tax legislation has permitted the Authority an alternative method in funding the purchase of new rolling stock. Based on an analysis by outside financial institutions, the Authority anticipates that 20 to 25% of the initial purchase cost can be financed by outside private corporations as permitted by the tax legislation. The balance would be funded by MTA bonds.

Therefore, of the $1,749 million cost of new rapid transit cars, approximately $350 million will be funded by private funds and the balance, $1,400 million, by MTA bonds.

The commodiousness of the fleet can be assessed by the percentage of cars with air conditioning, adequate lighting, and effective passenger communications systems. The latter items are being dealt with under the CORE program. It is proposed that air conditioning be installed by retrofitting almost 1,000 cars in series R-32 through R-40 before the end of the decade, ten of which would be included in the Five Year Capital Program as the prototype for the program. Along with the air conditioning retrofit already obligated for car series R-26 through R-36, and the replacement of older series by air conditioned new cars under the car purchase program, this will increase the percentage of the fleet which is air conditioned from its present level of 44% to 90% by the end of the decade. Without new car purchases, it is difficult to see how shop space or cars to be retrofitted with air conditioning could be made available in an effort to increase the percentage of air conditioned cars and thus the commodiousness of subway service.

TABLE I

CURRENT RAPID TRANSIT CAR FLEET

Car Series	IRT Cars in Service	Placed in Service Year
R-12	35	1948
R-14	78	1949
R-15	59	1950
R-17	370	1955
R-21	248	1956
R-22	443	1957
R-26	110	1959
R-28	100	1960
R-29	236	1962
R-33	533	1963
R-36	424	1964
Total	2,636	
	BMT/IND	
R-10	377	1948
R-16	114	1955
R-27	227	1960
R-30	317	1961
R-32	598	1965
R-38	196	1966
R-40	396	1968
R-42	396	1969
R-44	300	1973
R-46	754	1975
Total	3,675	
Total Fleet	6,311	

Chart 1: MDBF Decay as a function of car age, with and without overhaul program.

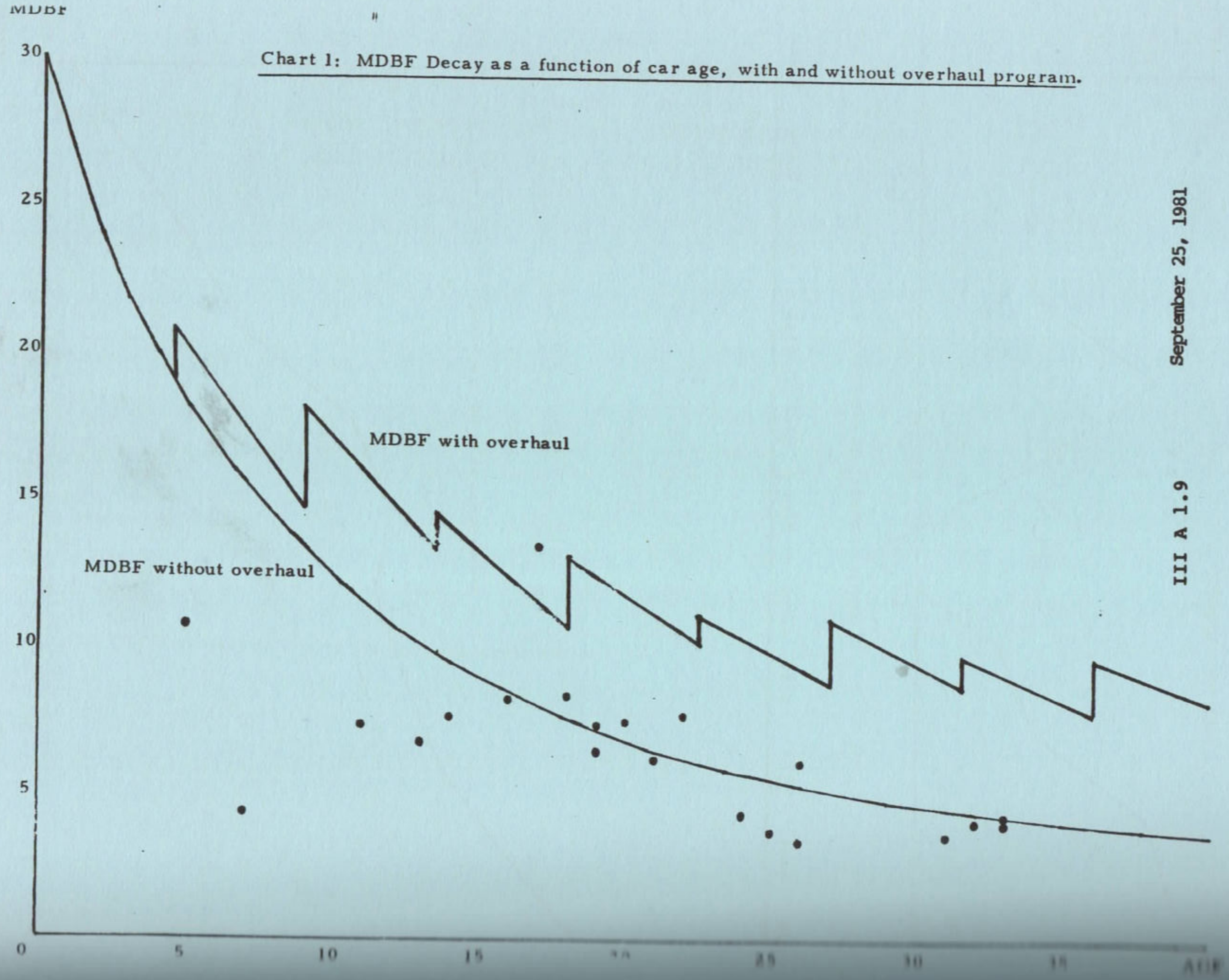

Chart 2: Fleet MDBF, 1971-1981: Rate of Change in MDBF

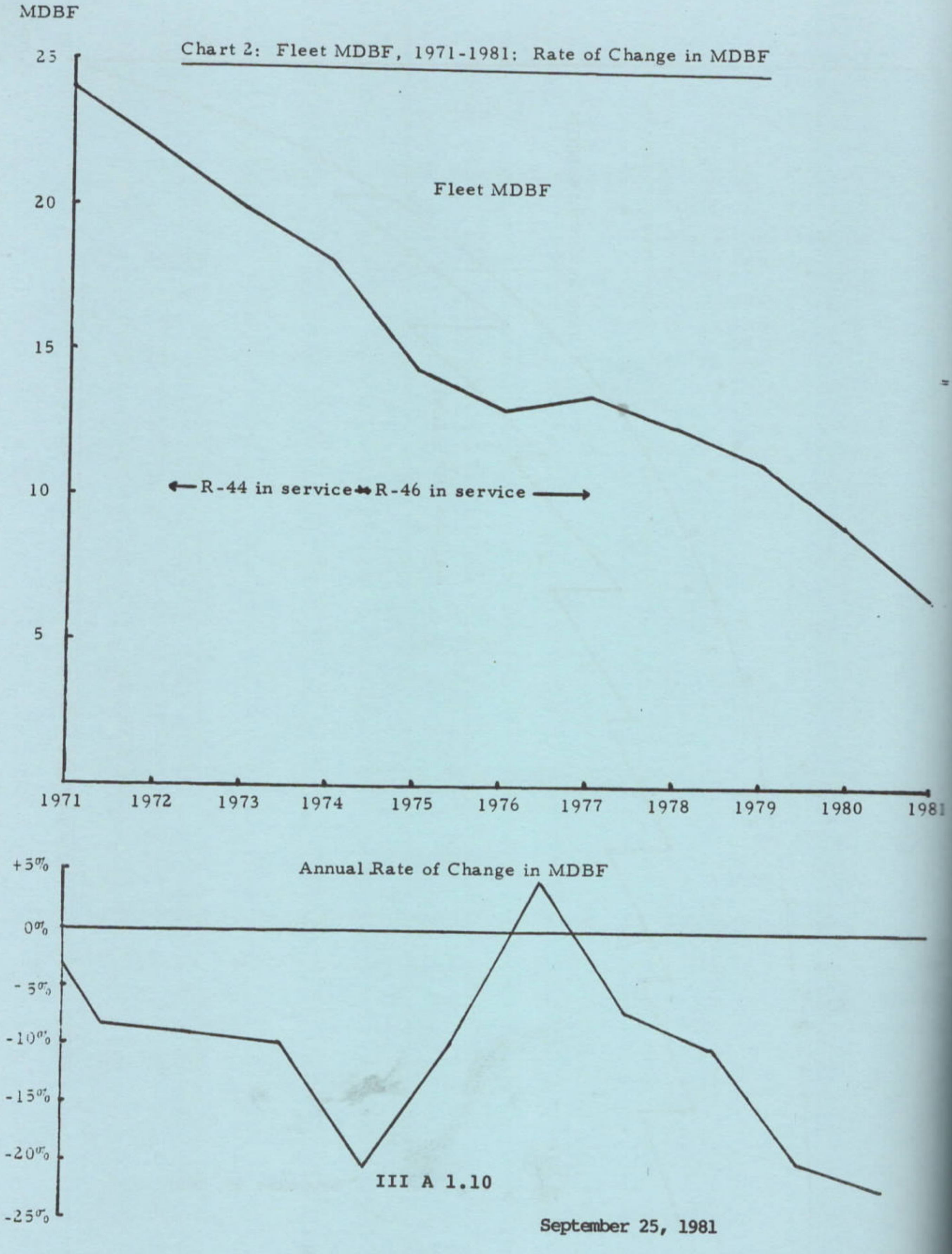

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Chart 3: Fleet Demand

	Actual 1978	Actual 1981	Projected 1982	Emerson Report Min.	1983	Max.	Projected 1983	Projected 1985	Projected 1987
Transportation Demand									
Cars Operated	4807	4854	4925	--	5115	--	4980	4930	4980
Logistics	219	194	175	--	132	--	150	130	125
Subtotal	5026	5048	5100	--	5247	--	5130	5060	5105
Maintenance Demand									
Inspections	137	117	120	118	--	211	122	125	116
Barn holds	199	343	305	154	--	239	285	250	150
Shop repairs	141	148	145	105	--	147	145	125	105
Reconditioning	42	9	9	--	50	--	0	0	0
Mods/Retrofits	45	80	95	40	--	82	110	10	20
Testing	41	30	30	--	30	--	40	40	30
Painting/Renovation	14	31	30	15	--	19	15	0	0
Wheel truing	18	22	22	22	--	22	22	22	22
Other shop work	69	66	66	--	66	--	66	65	65
Overhauls	0	0	4	26*	--	60	26	39	40
O.K. Mates	151	154	150	91	--	173	150	150	125
Stored Cars	399	61	35	--	0	--	0	0	0
Bad Order/Adjustment	94	202	200	--	214	--	200	200	185
Subtotal	1350	1263	1211	931	--	1313	1181	1026	858
Revenue Fleet	6376	6311	6311	6178	--	6560	6311	6086	5963

* Reflects 1980 recommendations of The Emerson Consultants

BUS FLEET STRATEGY

At the present time the Transit Authority and MaBSTOA operate a combined fleet of 4,560 buses. Attachment No. 1 lists the year of manufacture and the bus assignment for the fleet up to the Grumman Flexible purchase in 1980. As is noted, approximately 1,178 buses are over 12 years of age, and are beyond the useful life normally used throughout the industry. The 4,560 bus fleet includes 1,211 spares or 26% of the fleet.

Utilizing funding identified in the Five Year Capital Program, the Authority will purchase 1,605 buses over the five year period, permitting a reduction in the fleet size by timely retirement of old buses with low reliability. At the end of the Five Year Program the number of buses over 12 years of age will be reduced to 573. The 398 1975 Flexible Model 53102 buses are currently performing with low reliability. If this low reliability continues despite improved maintenance efforts then it would also be prudent to retire those buses by 1987. Such early retirement would improve the overall fleet reliability and reduce the fleet size from 4,560 to 4,000 with a spare factor of 16% by, at the latest, 1990. This reduction in fleet size is not related to a reduction in service levels. Rather, a more reliable, better maintained fleet will permit this fleet reduction. The make up of the fleet by the year 1990 showing the year of manufacture and the number of buses assigned to each operating authority is shown on Attachment No. 2.

In order to be in compliance with federal regulations dealing with transportation services for the elderly and the handicapped, up to 50% of the 4,000 bus fleet will be "lift equipped" buses.

The overall need for long term maintenance is compounded by many factors. These include:

- Lack of substantial experience in New York with the Grumman Flexible 870 or the General Motors RTS-4, which have required additional maintenance in other systems.
- Equipping of up to 50% of the fleet with lift equipment which is difficult to maintain.
- The step plan that must be used to replace bus depots and maintenance facilities will undoubtedly cause temporary disruptions of maintenance activities.

The measure of fleet reliability is the distance between road calls and is currently 681 miles for TA and 348 miles for OA. The goal of the five year plan bus purchase program will be to increase the distances to 1,000 miles and 500 miles respectively.

In order to improve the Authority's maintenance capabilities, a detailed program for modernizing existing depots which will remain in service as well as a program to replace existing depots has been developed. This will include the redesign, where space permits, of functional layouts to improve productivity and quality of work at selected surface maintenance facilities.

By 1990 the program will permit the Authority to achieve a 4,000 bus fleet with buses being replaced at the end of their 12th year of service.

The possible purchase of articulated buses is continually being reviewed. The Authority has applied to UMTA for a demonstration grant to permit the purchase of several articulated buses. To date, we have not received approval, although the MTA is continuing its negotiations with UMTA in order to obtain a grant. New depots will be designed to accommodate the longer articulated buses.

ATTACHMENT 1

SYSTEMWIDE BUS FLEET - EXISTING

YEAR OF MANUFACTURE	NUMBER OF BUSES NYCTA	MaBSTOA	TOTAL
1965	0	98	98
1966	136	480	616
1967	0	0	0
1968	133	0	133
1969	203	128	331
1970	200	0	200
1971	200	0	200
1972	206	126	332
1973	205	62	267
1974	0	0	0
1975	160	238	398
1976	0	0	0 (1)
1977	161	150	311
1978	0	0	0
1979	448	389	837
1980	255	222	477
1981	193	167	360
Subtotal	2500	2060	
GRAND TOTAL			4560

(1) 1976 Double decker buses Leyland AN-88A are no longer in operation

ATTACHMENT 2

PROPOSED SYSTEMWIDE BUS FLEET FOR 1990

YEAR OF MANUFACTURE	NUMBER OF BUSES NYCTA	MaBSTOA	TOTAL
1979	448	389	837
1980	255	222	477
1981	193	167	360
1982	174	151	325
1983	174	151	325
1984	174	151	325
1985	174	151	325
1986	163	142	305
1987	96	84	180
1988	96	84	180
1989	96	84	180
1990	97	84	181
TOTALS	2,140	1,860	4,000

LIRR

RAIL CAR PROGRAM

The Long Island Rail Road has sustained continued ridership growth, especially during rush hours. In the last seven years, peak period arrivals have increased by 37 percent at Penn Station. Over 12,000 commuters presently stand from 20 to 65 minutes every day. During the AM peak period, over 9,500 passengers stand on some 52 trains. Exhibit A shows the LIRR overall commuter growth since 1970. Of particular importance is the increase of some 32,000 daily commuters since 1973. During these same years, no additional M-1 cars have been added to the LIRR electric fleet.

Exhibit B details commuter growth by branch. As can be seen on this chart, the larger branches have continued to grow dramatically with the Babylon and Port Jefferson Branches, being the two largest branches, carrying the most standees.

The Rail Car Program is aimed at reducing the number of standees and allowing for the anticipated growth. The definition of a standee is perhaps easier to understand when viewed as to the length of time a standing commuter must stand. Exhibit C lists several stations where many of the morning commuters stand each day. It seems unreasonable, but we ask some of our commuters to stand up to 57 minutes in the morning.

Station dwell times are substantially increased as people take longer to enter and leave crowded trains. This adversely affects on-time performance. Providing seats for these standees will not only improve performance, but also enhance passenger perception of comfort and safety offered by the railroad.

Today, virtually all trains arriving in Penn Station from 7-9 AM have standees. Exhibit D shows the peak period train loadings at Penn Station, and specifically, the lack of several thousand seats for those passengers riding into Penn Station during the morning period. Penn Station is the LIRR's main terminal in New York. The importance of Penn Station to the LIRR can be seen from Exhibit E that depicts that over 80 percent of the morning passengers arriving at Western terminals are destined to Penn Station. It appears that as ridership continues to grow, a greater percent of car passengers will choose to arrive and depart from Penn Station. Exhibit E also shows the distribution of westbound passengers during the peak period.

By far, the largest number of these westbound passengers use Penn Station. An examination of Exhibit F shows the hourly distribution of these arriving passengers. This chart shows the increase in actual peak morning ridership at Penn Station from October 1979 to October 1980. The increases occurred in the 7-8AM, 8-9AM, and 9-10AM travel periods, where most standee conditions had already existed.

The most heavily travelled time period, 7-10 AM, continues to show a substantial, steady growth. Compared to other periods in the 12-hour spread between 4 AM and 4 PM, almost all passenger growth recorded at Penn Station has occured within this peak period. This continuation of growth has continued to put pressure on our morning operations and need for additional cars which offer people not just sitting space, but room to at least stand comfortably.

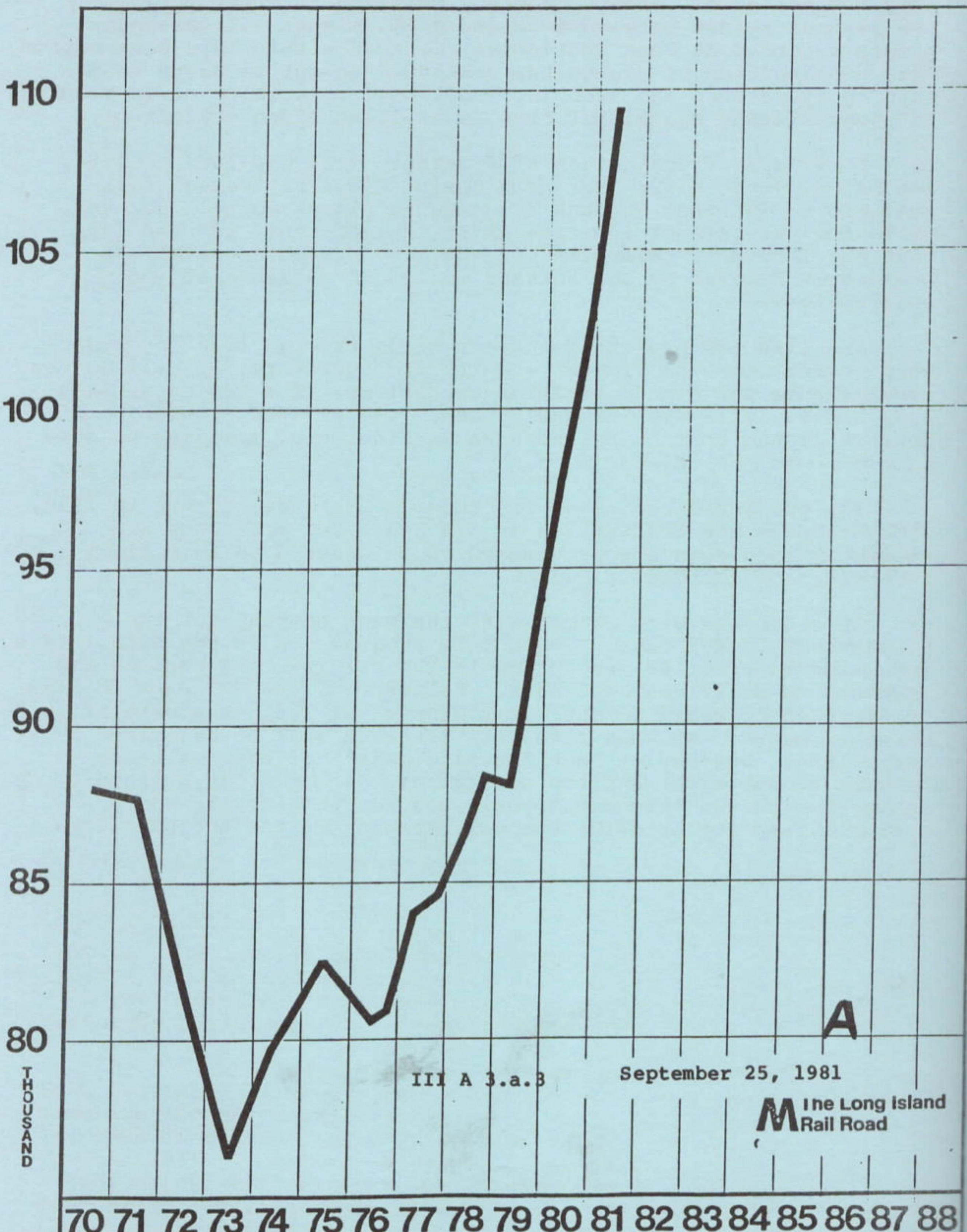
Looking at a projection of ridership from mid-1981 to 1984, Exhibit G, it is clear that peak period ridership demand will continue to increase, though at somewhat slower rates. However, it is not the rate of increase which is important, but the fact that any increase, regardless of the size, cannot possibly be adequately handled by our current equipment assignments and availability.

The LIRR has projected its car needs through 1990 for ridership growth from the present electrified territory, as well as the requirements for electrification extensions. The new cars, when they arrive, will significantly reduce the standee problem, but because of the continuing increase in ridership, standees on some trains would remain.

The projected car needs for today's standees, growth to 1990, and Northport electrification is 316 M-3s; 100 more cars are needed by 1990 than are programmed to be ordered in this first five years of the Capital Plan.

An order has been placed with the Budd Company for the purchase of 70 M-3 cars. Under this program, it is the Authority's intention to exercise the option in the original bid package and purchase an additional 146 cars. Delivery of the M-3 cars to LIRR is expected to begin in the first quarter of 1983 at a rate of 20 cars per month. At this rate, all 216 cars will be delivered by early 1984. One car of each "married-pair", of cars of bothe initial 70 car order and the additional 146 car order will be equipped with two "tie-down" positions for wheelchairs and a portable ramp for bridging the gap between the car and platforms.

Daily LIRR Commuters



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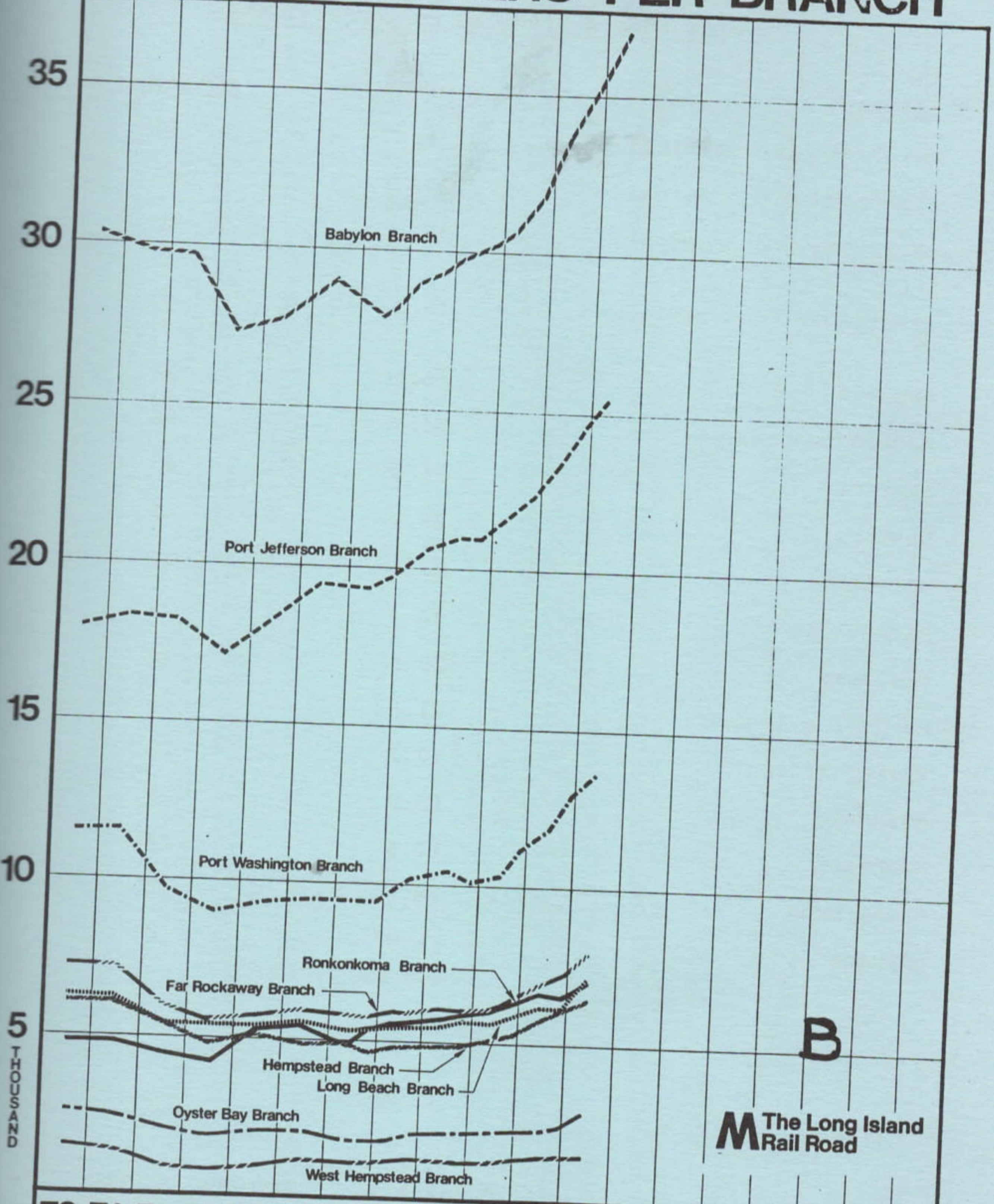
DAILY COMMUTERS PER BRANCH



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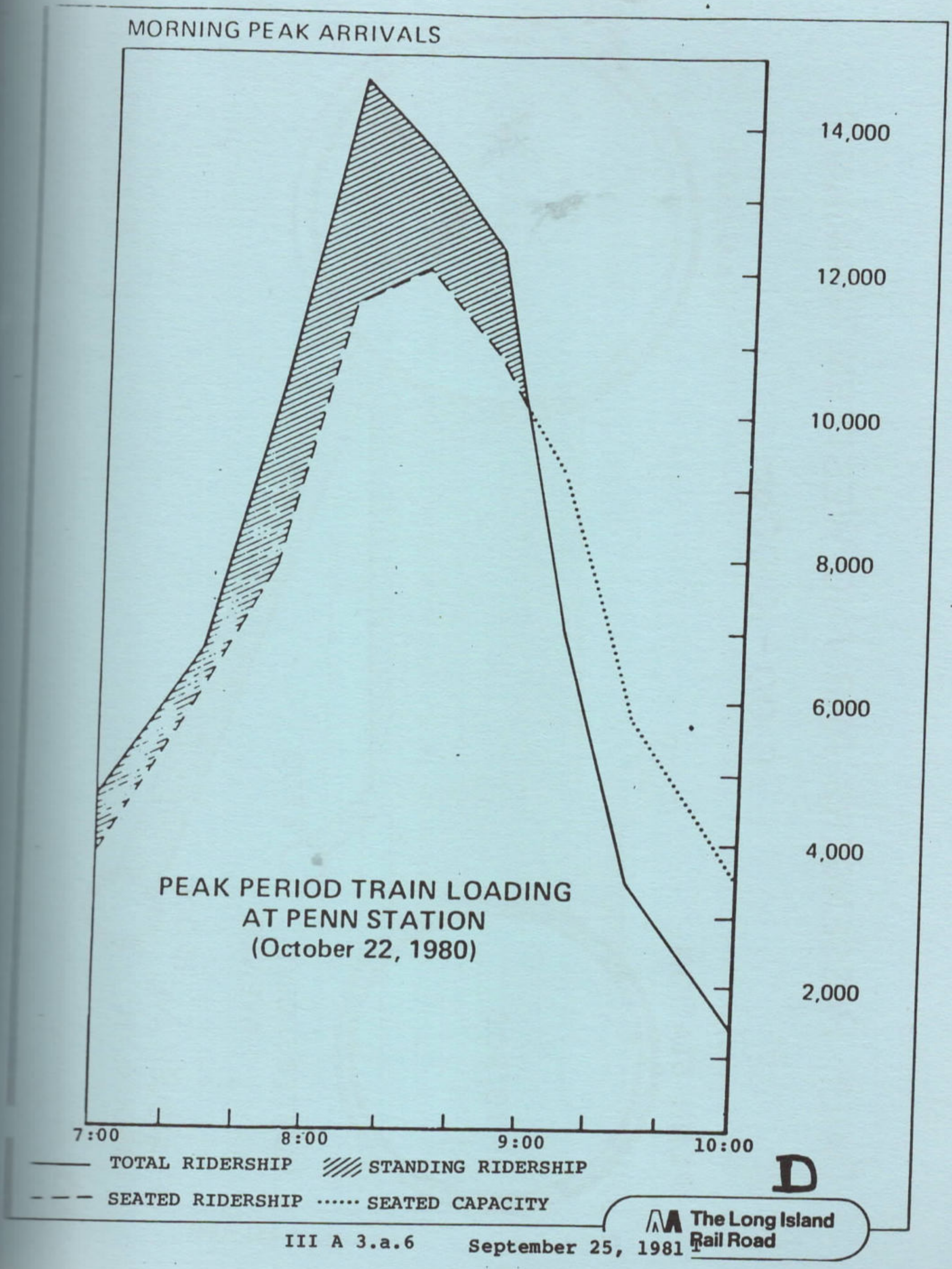
HOW LONG A STANDING COMMUTER STANDS

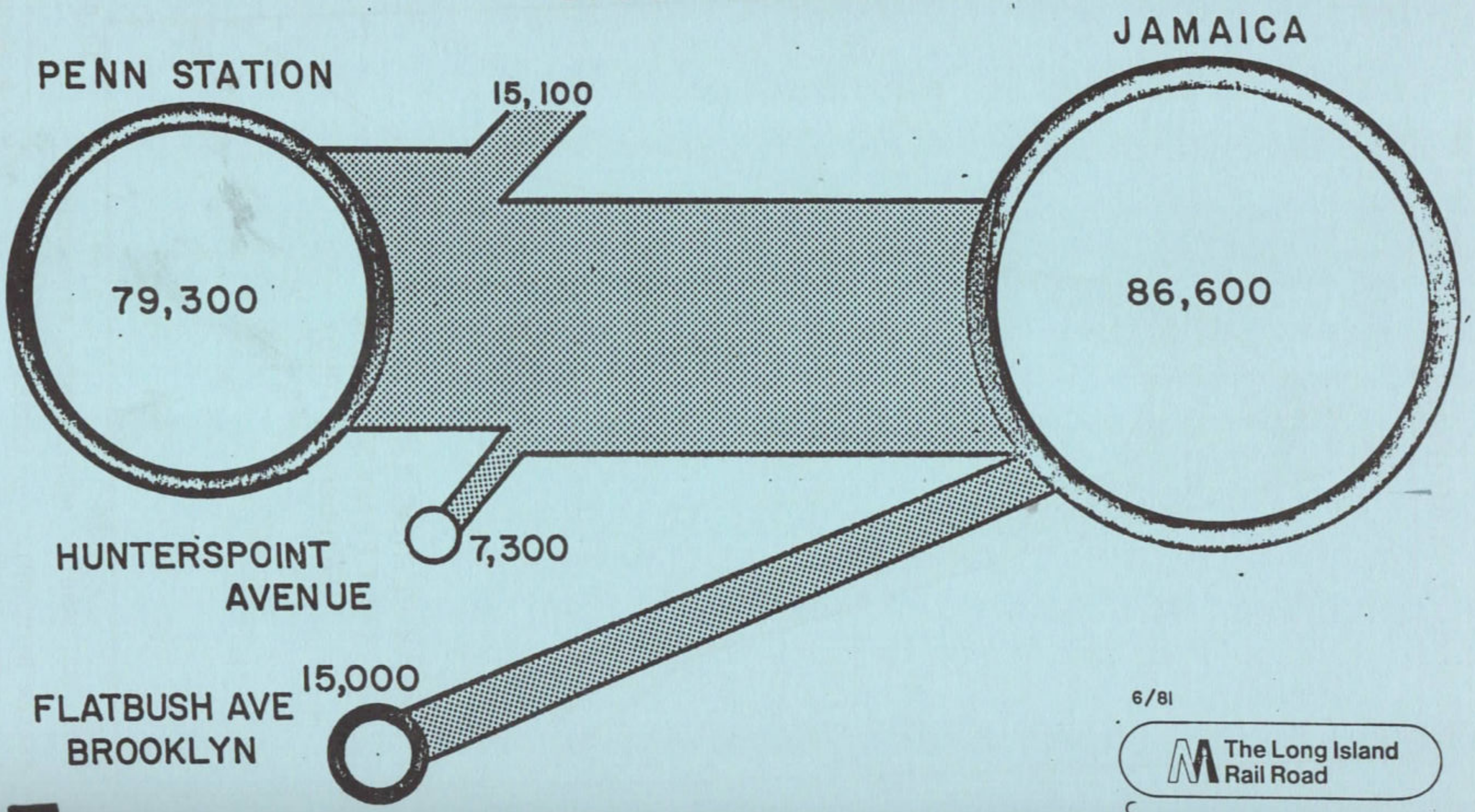
Station	# Miles	# Minutes
Bay Shore (to Jamaica)	31.7	46
Wyandanch (to Jamaica)	25.3	42
Greenlawn (to Jamaica)	28.1	42
Jamaica to Penn Station	11.2	20
Babylon	38.8	57
Huntington	36.6	56
Syosset	31.0	45
Seaford	29.9	45
Merrick	26.3	40
Hicksville	26.7	39
Westbury	23.3	36
Rockville Centre	21.5	33
Valley Stream	17.7	32
Rosedale	15.9	29
Manhasset	17.3	26
Great Neck	15.8	24
Bayside	12.7	22



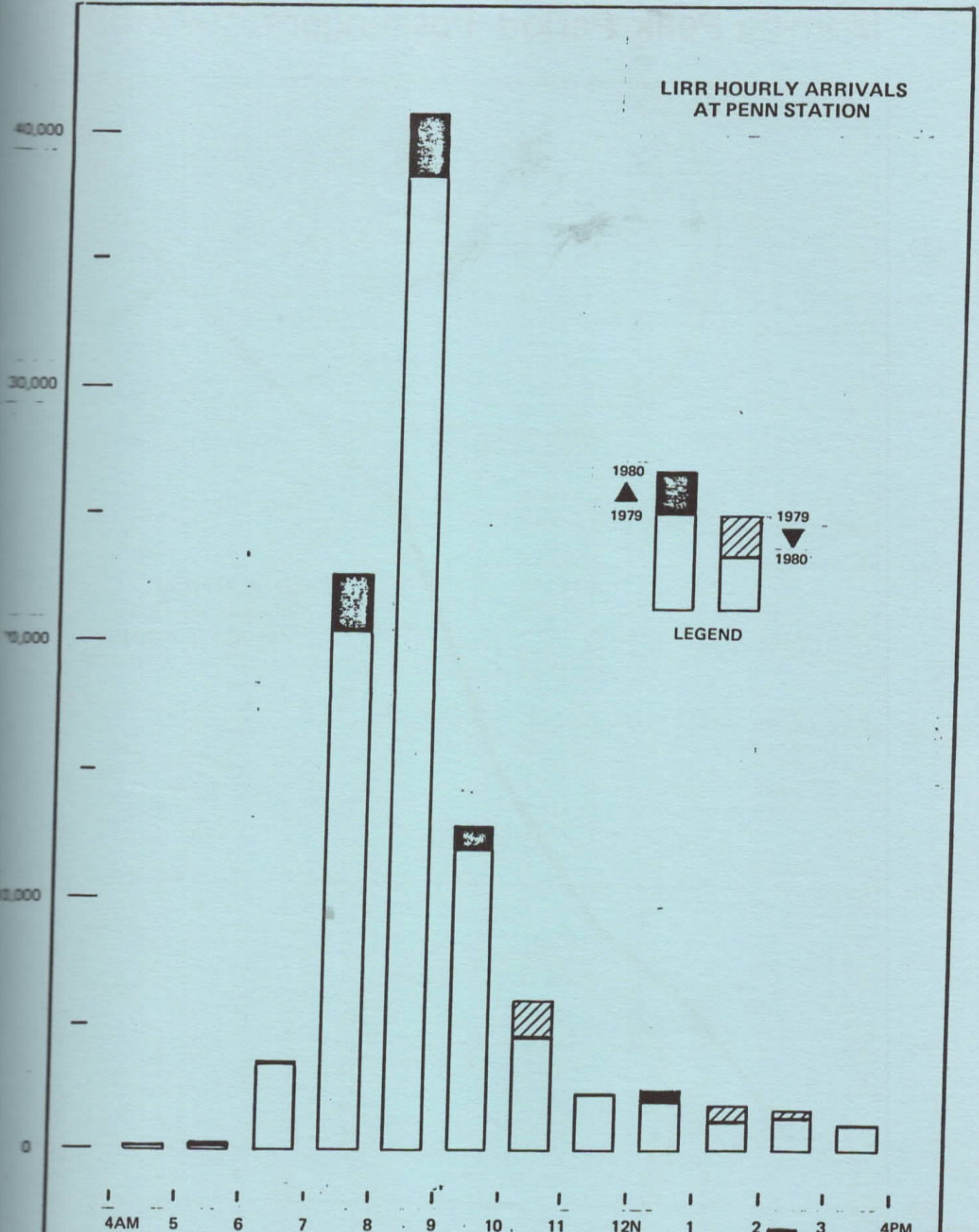
MORNING PEAK ARRIVALS
14,000
12,000
10,000
8,000
6,000
4,000
2,000
PEAK PERIOD TRAIN LOADING
AT PENN STATION
(October 22, 1980)
7:00
8:00
9:00
10:00
TOTAL RIDERSHIP
STANDING RIDERSHIP
SEATED RIDERSHIP
SEATED CAPACITY
D
The Long Island Rail Road

DAILY PASSENGERS ARRIVING WESTERN TERMINALS

6:00 - 10:00 am



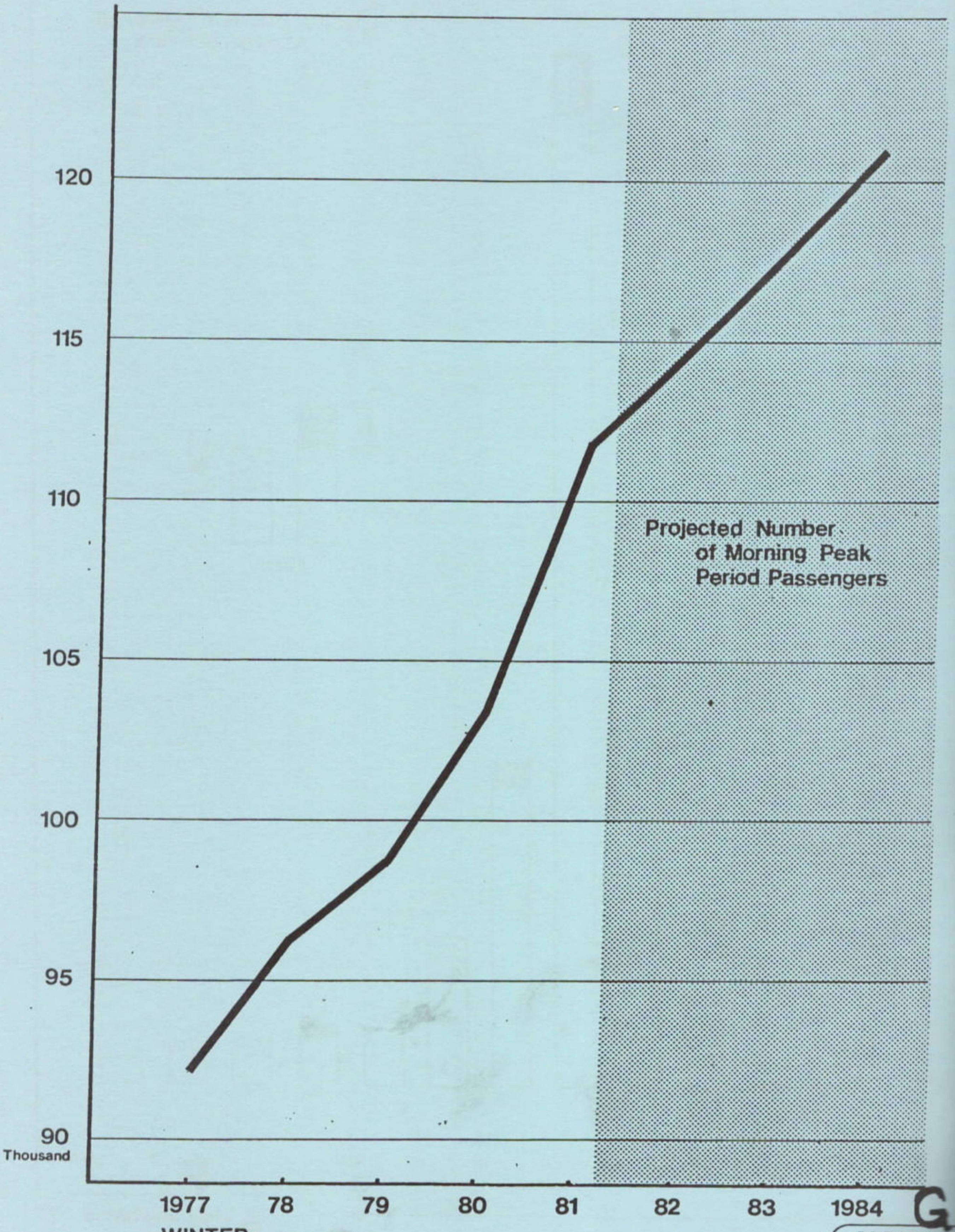
E



F

The Long Island Rail Road

Morning Peak Period Passengers: 1977-84



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The Long Island Rail Road

III A 3.a.9

September 25, 1981

METRO-NORTH COMMUTER CAR PROGRAM

The Metropolitan Region presently carries over 5,500 standees each weekday morning on 52 of its peak period trains. Many of these commuters stand for as long as 45 minutes. While this represents an inconvenience to the commuters, it presents many other important problems.

(1) Overcrowded commuter trains pose potential safety problems, such as injuries due to sudden stops and passengers standing in close proximity to doorways.

(2) Excessive passenger loads render even a well functioning air conditioning system ineffective.

(3) The ability of on-train personnel to properly patrol their trains and collect revenues is impeded.

(4) As passengers seek out comfortable space, the loading time at such stations increases, resulting in delays to the trains.

An available car fleet of appropriate size, therefore, contributes to passenger safety and comfort, overall dependability of the service and facilitates on-board collection of revenue. Passengers, employees and the Region itself all benefit from the very existence of an adequate car fleet.

While, admittedly, part of the standee situation is caused by high out-of-service rates of presently operated equipment, standee conditions would still exist on 25 trains even if car availability from the present fleet was normalized. Clearly the car fleet must be expanded, not only to accommodate present ridership but to handle anticipated ridership expansion in the next five years.

To address Metro-North's needs through 1985, the 5-Year Capital Plan envisions the following actions:

(1) Purchase of an additional 82 M-3 Cars over and above the 60 already on order, with delivery to be in 1984-5. While it was anticipated that the first 60 M-3's would provide equipment for the Upper Harlem Electrification, in fact these cars will be absorbed into presently electrified zone service as soon as they are delivered.

(2) Purchase of an additional 44 M-2 Cars for the New Haven Line (MTA portion of the required 110), to be delivered in 1985. New Haven Line car demand, as

was the Harlem-Hudson car demand, was computed by adding 5% ridership growth per year to each individual equipment cycle, adding cars when passengers exceeded train capacities. As cars must be added in pairs, the added capacity would then be sufficient for several years thereafter on each equipment cycle. The demand, as computed, would be capable of handling a somewhat larger increase in overall ridership. Conversely, similar demand figures would be generated by somewhat lower increases in ridership. It is interesting to note that the New Haven Line car demand figures produced by this approach were subsequently borne out in DeLeuw, Cather's Rail Car Fleet Study by use of a multi-modal cross-elasticity demand model.

(3) For the Upper Hudson Line, for which there are no plans for electrification, the 5-Year Capital Plan provides for rebuilding 24 4400 Series Cars retired from electric service on the New Haven Line. These cars will be rebuilt as push-pull coaches, providing passenger amenities equivalent to more expensive new cars at approximately half the cost. These cars would be used in conjunction with the seven recently re-manufactured FL-9 Locomotives, which will be retrofitted to provide locomotive generated power for car heat, light, air conditioning, etc.

(4) The existing M-2 fleet is equipped with transformers with coolant containing PCB's the concentration of which has been declared excessive by recent Federal Regulation. The 5-Year Capital Plan provides funding for replacement of these transformers, the worst case situation. If less expensive retrofill procedures (purge and coolant replacement) prove to be a satisfactory response to this Regulation, the remaining funds will be used toward overhaul of the MU Cars on the Harlem and Hudson Lines.

The 5-Year Capital Plan, together with the timely completion of overhaul of the present fleet of cars will provide a fleet of cars adequate for:

(1) Forseeable demand in 1985.

(2) A reasonable shop margin of equipment.

(3) The removal of cars from service on a cyclical basis for preventive maintenance. This regular overhaul of

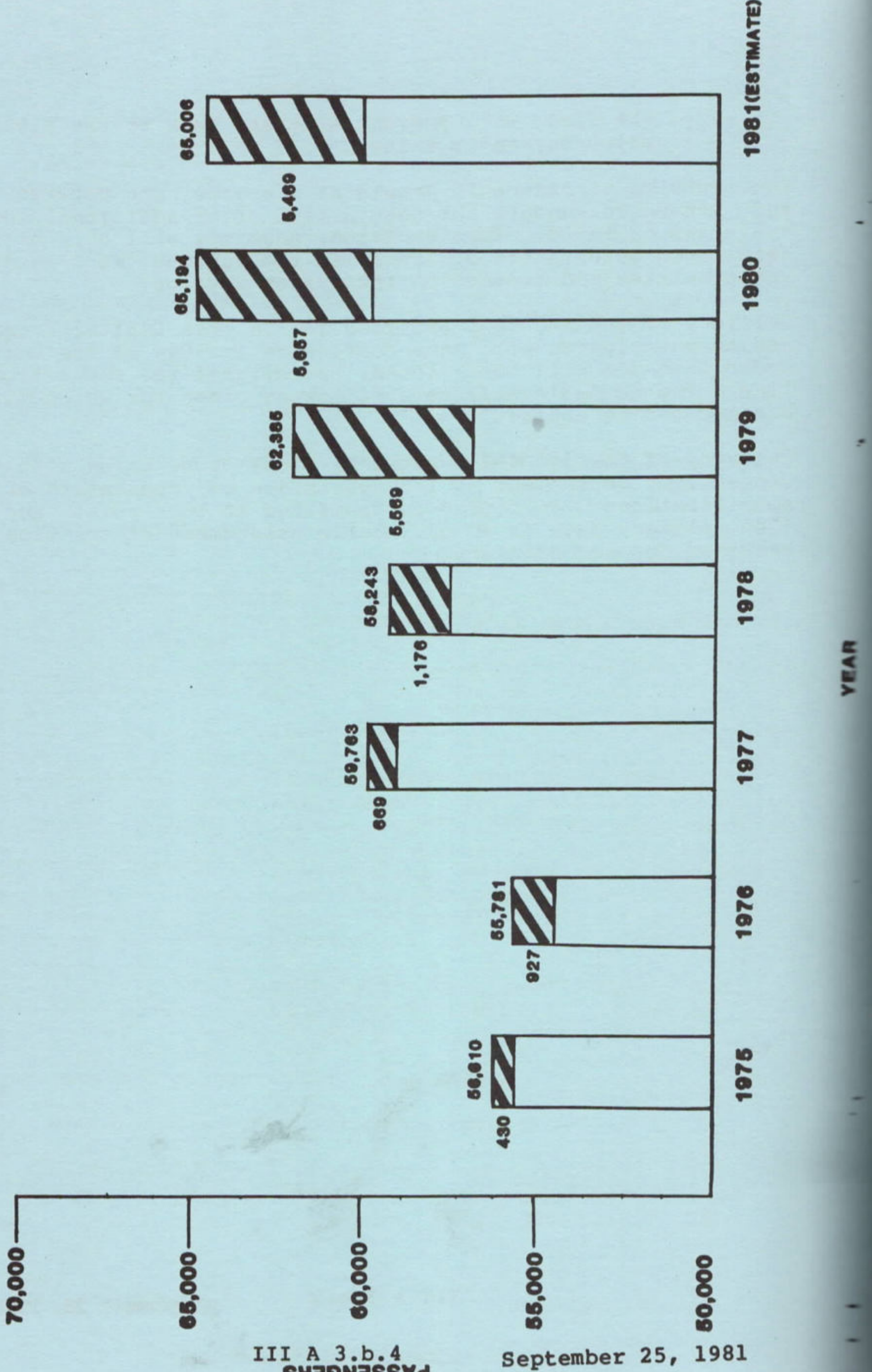
the fleet will prevent slippage back to the situation which currently exists.

Continuation of ridership growth at the same rate between 1986 and 1990 would mandate the acquisition of an additional 106 M-3's and 82 M-2's. This decision, however, will only be the results of observation of trends as the various improvements are completed and demands on the System develop.

Delivery of the M-3 Cars provided for in this Capital Program can be anticipated with some confidence in 1984 as the initial order of M-3's will have already established the production line. The 82 M-3's will be a follow-on order for which MTA already has an option.

Delivery of the 110 M-2's requires close cooperation with the Connecticut Department of Transportation on preparation of specifications. No bidder is committed at this point, and the 1985 delivery date is an optimistic assessment of the time required for car delivery.

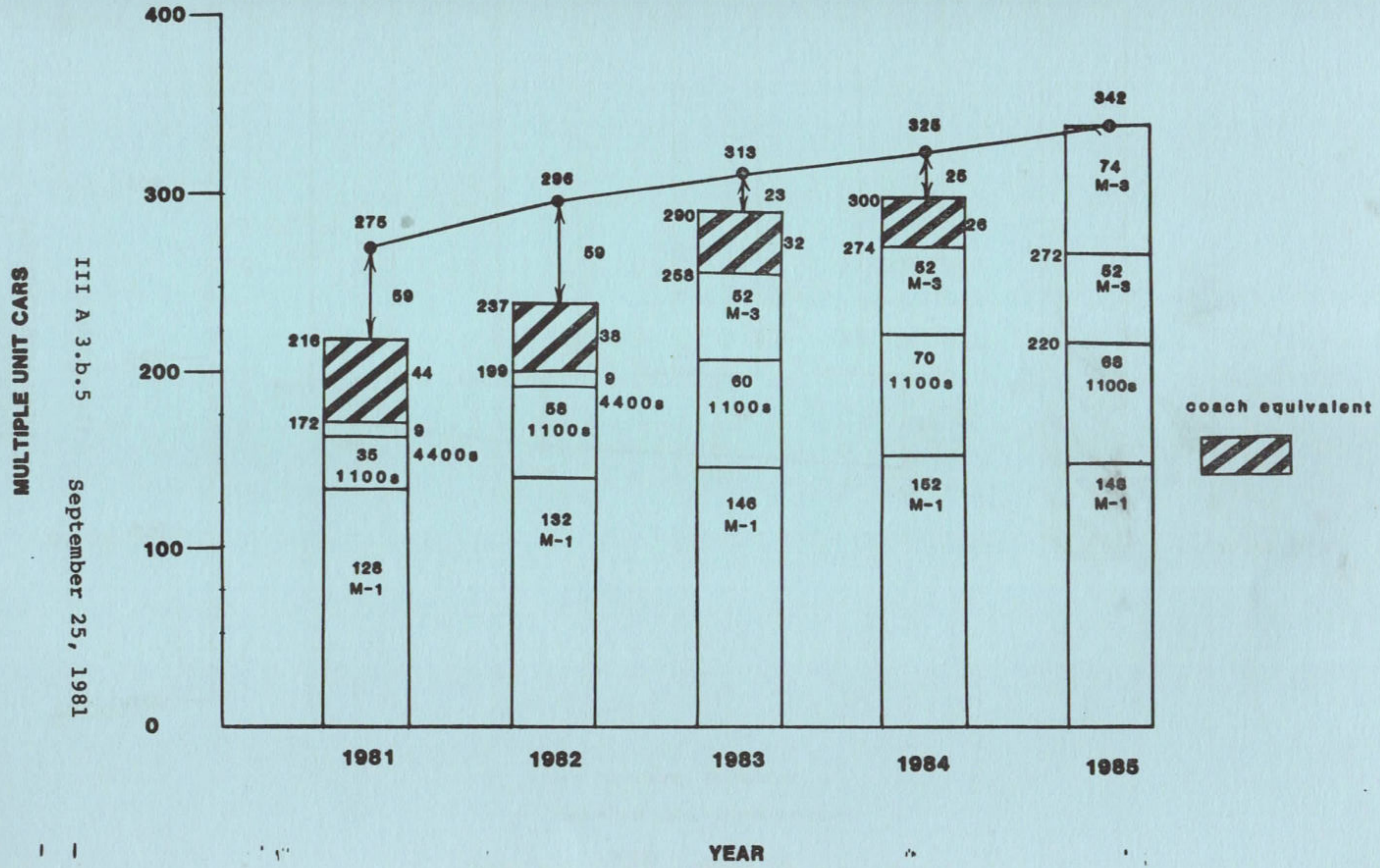
RIDERSHIP AND STANDEES AM PEAK PERIOD



HARLEM-HUDSON LINE

CAR AVAILABILITY VERSUS DEMAND

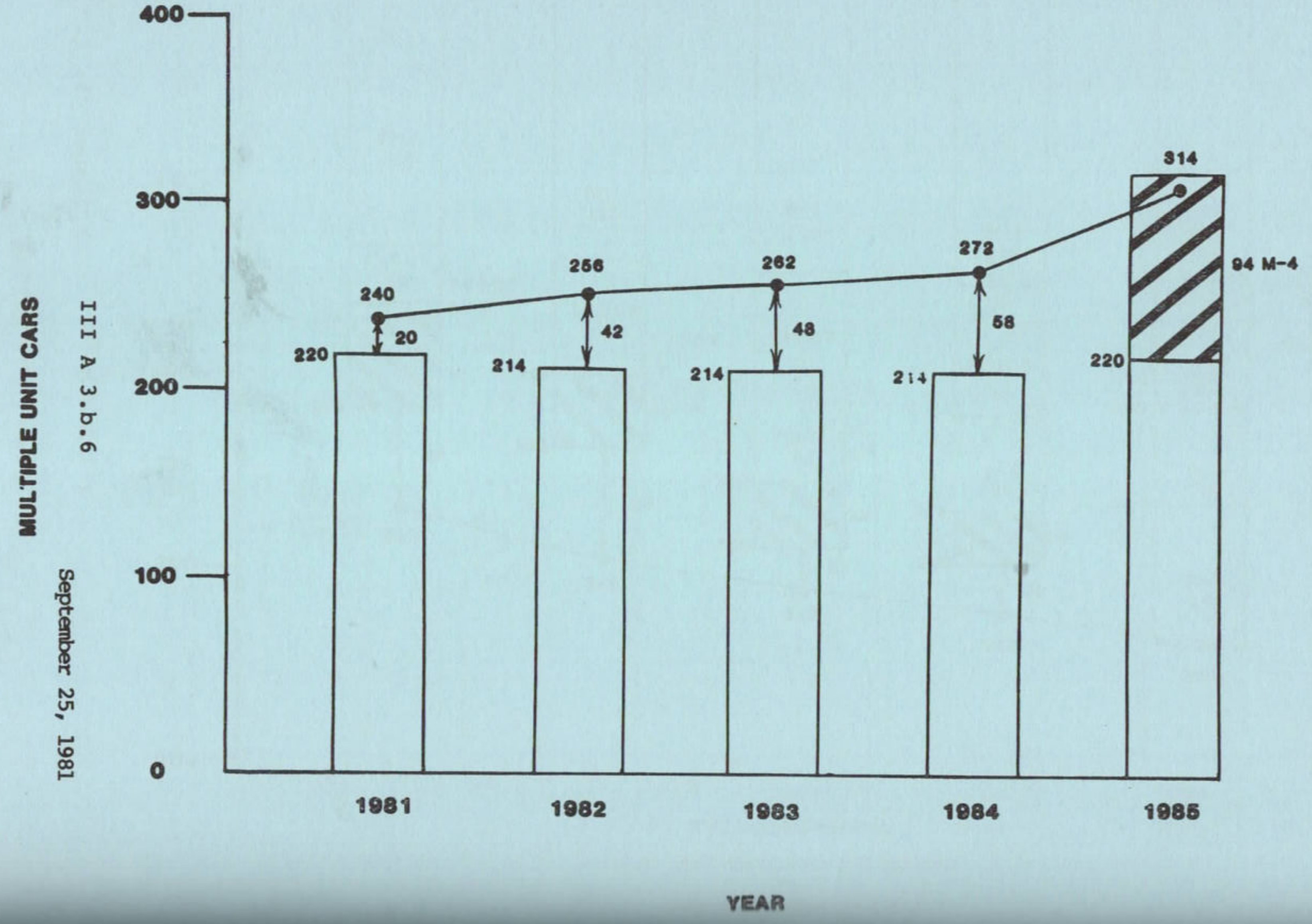
ELECTRIC EQUIPMENT



NEW .VEN LINE

CAR AVAILABILITY VERSUS DEMAND

ELECTRIC EQUIPMENT



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September 25, 1981

BUS DEPOT PROGRAM - STRATEGY

The Transit Authority currently operates 13 bus depots and MaBSTOA operates 9 depots for a total of 22 depots. The geographical location, year of construction and bus storage statistics are shown on the attached Figures 1, 2 and 3.

In analyzing the existing physical plant, it is obvious that many of the depots should be totally replaced. Eight of the depots, predominately in the MaBSTOA system, were constructed between 1885 and 1918 for purposes other than bus operations. Several other depots will not accommodate the newer type buses which have been recently purchased.

In view of the difficulty the Authority has had in acquiring property for new bus depot sites, the plan for renewing the physical plant of MaBSTOA involves the replacement of some depots in place. The implementation of the plan has already begun with the approval by the Board of Estimate for the acquisition of the Gun Hill Bus Depot site. Once this facility is placed into operation, the next MaBSTOA depot (Kingsbridge) will be taken out of service, its structure demolished, and a new depot built on the current site. The sequencing of the step plan is shown on Figure No. 4.

Overall, the Authority plans to build ten new bus depots. One, Walnut Bus Depot, is already funded as part of the FY 1981 program. Four new bus depots will be constructed as part of the Five Year Capital Program (one for TA and three for MaBSTOA). The remaining five new bus depots will be constructed beyond 1986, (three for TA and two for MaBSTOA). In addition, it is expected that the MaBSTOA Hudson Bus Depot will be replaced with a new depot at 33rd Street and 11th Avenue as part of the Westway Project.

The Authority also plans to modernize eleven existing depots as part of the Five Year Capital Program. A survey of the needs for all bus depots was made and a summary of the results of this survey is shown on Figure No. 5.

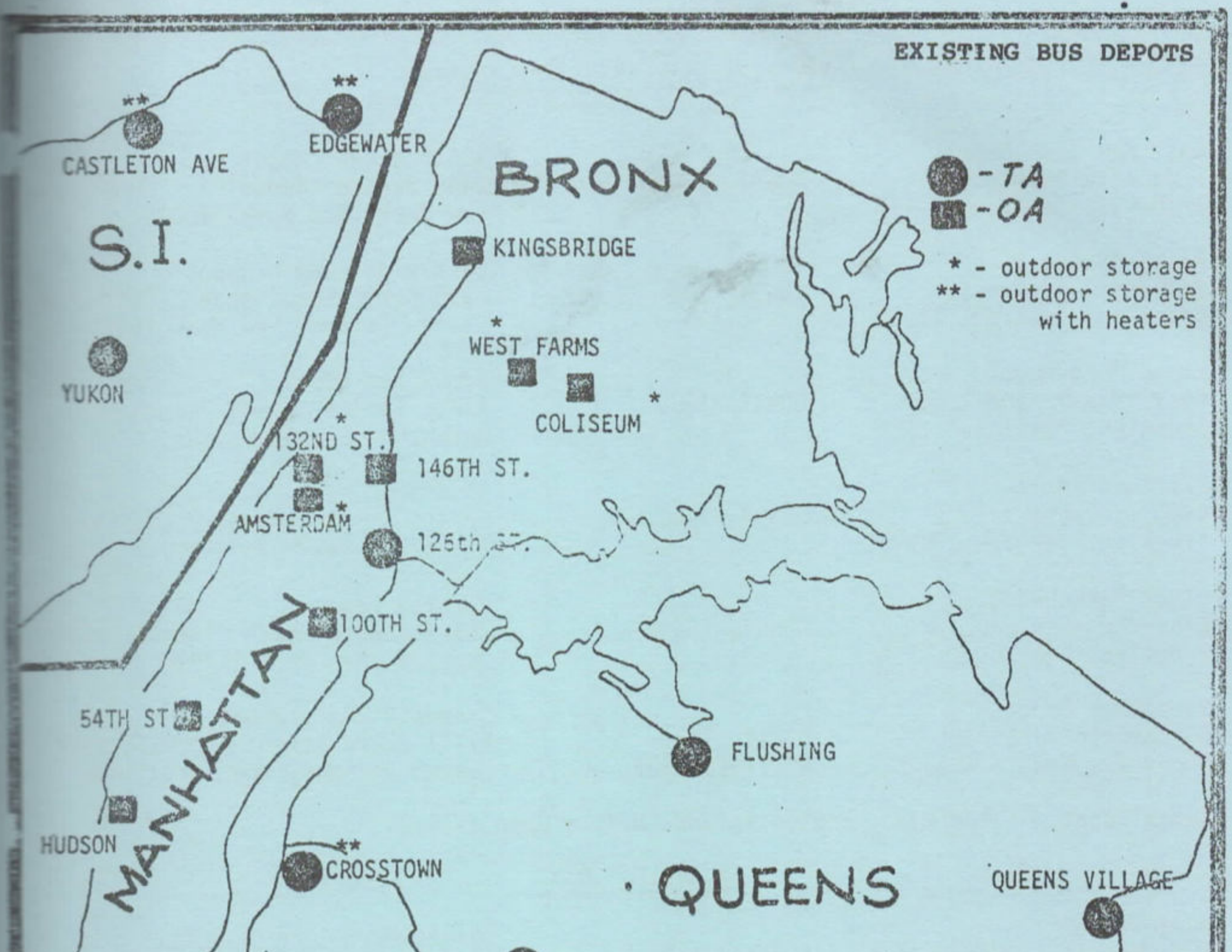
In addition to the bus depot facilities, the Five Year Capital Program includes construction of a new Bus Maintenance Shop and Central Stores Building for MaBSTOA at the Gun Hill site and a Truck Repair and Administrative Facility for TA at East New York.

In developing the needs for a bus depot, it is important to recognize the various functions performed at a depot such as:

- Storage of buses
- Servicing of buses i.e., fueling, washing, fare collection, inspection, lubrication, overhauls and maintenance.
- Reporting location for bus drivers where they are given special instructions.
- Command center where dispatchers run their routes.
- Location of Road Service vehicles for emergency road service.

In modernizing the depots, special emphasis will be placed on improving workers' productivity. This will be accomplished within the constraints of the existing site and existing structure by upgrading equipment such as hoists and bus washers, improved lighting, heating ventilation, improved work flow including redesign and/or relocation of parts supply systems, and other stores, modernizing employee facilities such as wash rooms, locker rooms and lunch rooms, and a general rehabilitation of the basic structure. The Authority will utilize Industrial Engineering expertise in order to develop the improved productivity and a higher quality of work as well as improved employee morale. All construction work will be scheduled so as to permit the depot to operate continuously with a minimum of interference.

Each new depot will also be designed to permit an efficient work place. Again, Industrial Engineering expertise will be utilized to the fullest to achieve these goals. The new depots will also be designed to accommodate articulated buses which may be purchased in the future. The interior storage areas for the buses will be of long span construction to reduce the number of columns which restrain the flexibility and ease of parking buses.


EXISTING BUS DEPOTS
-TA
-OA
* - outdoor storage
** - outdoor storage with heaters
S.I.
BRONX
MANHATTAN
QUEENS
BROOKLYN
**
CASTLETON AVE
**
EDGEWATER
KINGSBRIDGE
YUKON
*
WEST FARMS
COLISEUM
*
*
132ND ST.
146TH ST.
*
AMSTERDAM
125th ST.
100TH ST.
54TH ST
HUDSON
FLUSHING
**
CROSSTOWN
QUEENS VILLAGE
FRESH POND
*
JAMAICA
EAST NEW YORK
**
FIFTH AVE
**
FLATBUSH
*
ULMER PARK
FIGURE 1

EXISTING BUS DEPOTS

NEW YORK CITY TRANSIT AUTHORITY

East New York Depot
1 Jamaica Avenue
Brooklyn, New York 11207 — CONST. 1950

Fifth Avenue Depot
847 Fifth Avenue
Brooklyn, New York 11232 — CONST. 1885

Fresh Pond Depot
66-99 Fresh Pond Road
Brooklyn, New York 11227 — CONST. 1960

Flatbush Depot
4901 Fillmore Avenue
Brooklyn, New York 11234 — CONST. 1950

Ulmer Park Depot
2449 Harway Avenue
Brooklyn, New York 11214 — CONST. 1950

Crosstown Depot
65 Commercial Street
Brooklyn, New York 11222 — CONST. 1948, MODIFIED 1955

126th Street Depot
2460 Second Avenue
New York, New York 10035 — CONST. 1949

Castleton Avenue Depot
1390 Castleton Avenue
Staten Island, New York 10310 — CONST. 1950

Edgewater Depot
1 Bay Street, Pouch Terminal
Rosebank, Staten Island, N.Y. 10305

Flushing Depot
123-53 Willets Point Boulevard
Flushing, New York 11368 — CONST. [illegible]

Jamaica Depot
165-18 South Road
Jamaica, New York 11433 — REHAB. 1950

Queens Village Depot
97-11 222nd Street
Queens Village, New York 11428 — CONST. 1974

Yukon Depot, Yukon Ave., Staten Island, N.Y. - Open 7/15/81

M.A.B.S.T.O.A.

Hudson Pier
15th Street & Hudson River
New York, N.Y. 10011 — ACQUIRED 1971, CONST. 1949

54th Street Depot
806 9th Avenue
New York, N.Y. 10019 — CONST. 1909, MODIFIED 1936

100th Street Depot
1550 Lexington Avenue
New York, N.Y. 10029 — CONST. 1895, MODIFIED 1936

132nd Street Depot
605 West 132nd Street
New York, N.Y. 10027 — CONST. 1918, MODIFIED 1938

146th Street Depot
101 West 146th Street
New York, N.Y. 10039 — CONST. LATE 1890's, REBUILT 1939

Coliseum
1100 East 177th Street
Bronx, N.Y. 10460 — CONST. 1900

West Farms #1
1811 Boston Road
Bronx, N.Y. 10461 — CONST. LATE 1890, REBUILT 1925

West Farms #2
1801 Boston Road
Bronx, N.Y. 10461 — SAME

Kingsbridge
4065 Tenth Avenue
New York, N.Y. 10034 — CONST. 1897

Amsterdam (128th Street)
1381 Amsterdam Avenue
New York, N.Y. 10027 — CONST. 1947

FIGURE 2

EXISTING FACILITIES - BUS STORAGE STATISTICS

LOCATION	AGE	TOTAL AREA (3)	INDOOR AREA	OUTDOOR AREA	TOTAL BUSES	TOTAL STORED OUTDOORS	TOTAL STORED INDOORS
Bronx							
Coliseum (1)	80	233,000	114,000	54,016 (4)	220	134	86
West Farms (2)	90	97,000	110,000		185	14 (5)	171
Kingsbridge (2)	83	126,000	223,000		316	-	316
Manhattan							
126th Street	31	101,000	101,000		152	-	152
146th Street	41	130,000	130,000		216	-	216
Amsterdam	33	73,000	73,000		145	38 (5)	107
132nd Street (1) (2)	62	133,000	82,000	50,000 (4)	170	90	80
100th Street (2)	35	32,000	153,000		[illegible]	-	[illegible]
54th Street (2)	71	85,000	159,000		192	-	192
Hudson (2)	31	500,000	476,000		199	-	199
Brooklyn							
East New York	32	256,000	146,000	30,000	219	-	219
Flatbush (1)	30	214,000	138,000	76,000 (4)	238	95	143
Ulmer Park (1)	30	223,000	119,000	104,000 (4)	224	75	149
5th Avenue (1)	95	216,000	110,000	106,000 (4)	190	120	70
Crosstown (1)	32	76,000	15,000	61,000 (4)	77	77	0
Queens							
Queens Village	6	274,000	202,000	-	210	-	210
Fresh Pond (1)	20	142,000	126,000	16,000	176	-	176
Jamaica (1)	41	165,000	92,000	73,000 (4)	152	70	82
Flushing (1)	30	210,000	170,000	40,000	199	-	199
Staten Island							
Edgewater (1)	31	291,373	77,740	72,450 (4)	185	140	45
Castleton (1)	30	201,000	126,000	75,000 (4)	223	124	99
				TOTALS	4098 (6)	977	3121

NOTES

(1) Depot has outdoor storage capability.

(2) Two story depot.

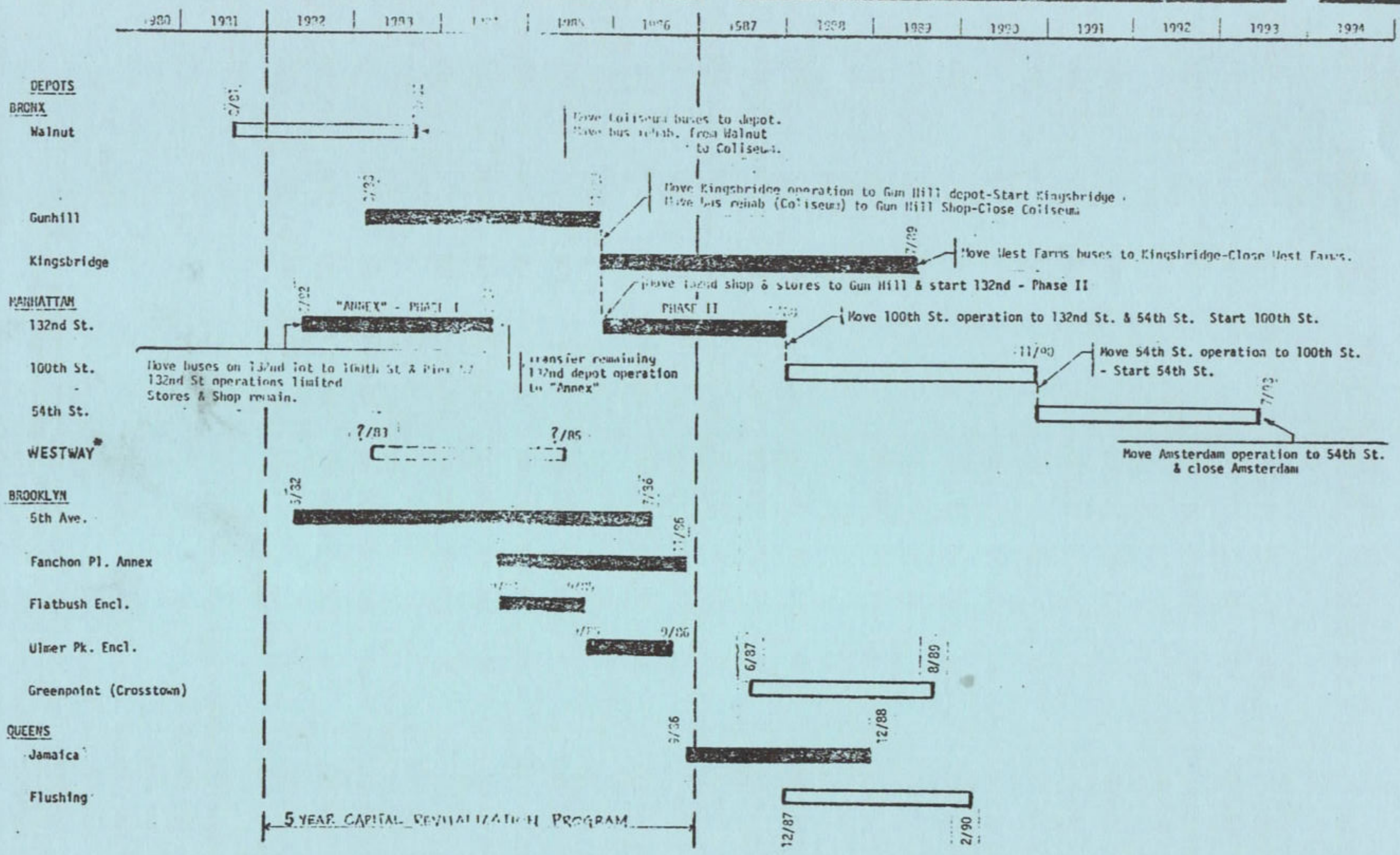
(3) Land area.

(4) Buses stored outdoors at this location.

(5) Buses stored in street.

(6) Does not include 600 + buses awaiting repair or scrapping at the Walnut, Brooklyn Army Terminal, Linden, Kingsbridge and White Plains Road Line subway terminal.

Figure 3



NOTES

1) DATES SHOWN ARE START OF CONSTRUCTION & FACILITY OPERATIONAL

2) *REPLACEMENT FOR PIER 57 - NOT BEING BUILT BY T.A.

NEW BUS FACILITIES CONSTRUCTION PROGRAM

SEQUENCE

Figure 4

SUMMARY - FACILITIES REQUIRING REHABILITATION OR MODERNIZATION

	Coliseum	West Farms	Kingsbridge	126th St.	146th St.	Amsterdam	132nd St. (incl.shop)	100th St.	54th St.	Hudson (Pier 57)	East N.Y. (incl.shop)	Flatbush	Ulmer Park	5th Ave.	Crosstown	Queens Vill.	Fresh Pd.	Jamaica	Flushing	Castleton	Edgewater
RIOR:																					
Roof (incl.skylights)	●	●		●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●
Masonry		●			●		●	●	●		●	●	●	●		●	●	●	●	●	
Windows & screens (incl.frames)	●	●	●	●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	●
Skylights			●		●			●						●					●		
Doors (incl.frames)	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●	●		●
Paving	●	●	●			●	●	●	●	●	●	●	●	●	●			●	●	●	●
Smokestacks					●	●	●				●			●					●	●	
INTERIOR:																					
Masonry	●		●		●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	
Interior Finish (paint, etc.)		●		●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	
Floors, ramps	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●
Fuel Tanks					●		●	●	●					●			●	●			●
Structural	●	●	●	●		●	●	●	●		●			●				●	●		●
MS:																					
Electrical	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Lighting	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●
Air		●	●	●	●	●	●	●	●		●	●	●	●			●	●	●	●	●
Boilers/Heating	●	●		●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Fire Protection	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Bus washers		●	●	●	●	●	●		●	●		●	●	●	●		●	●	●		●
Bus hoists	●	●	●	●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	
Ventilation/bus exhaust	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Heat Curtains	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
O. H. Lubrication	●	●	●	●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	●
Fuel Station	●	●		●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Plumbing/Drainage	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Oil Separators	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Battery Charging	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
SPECIAL:																					
Electrical or Vapor Heaters												●		●	●						
Elevators							●				●										
ot or Shop Equipment	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
Wells											●	●	●	●			●	●	●	●	
Administrative/Employee Facilities	●	●	●		●	●	●	●	●		●			●	●						●

Figure 5

TRANSIT AUTHORITY MAINTENANCE FACILITY PROGRAM STRATEGY

The Authority currently operates 2 main car repair shops (Coney Island and 207th Street) and 13 car barns, 9 for inspections and 4 for trouble repairs. The geographical location of all barns and shops are shown in Figure 1. The number of cars assigned to each inspection barn is shown in Figure 2. The Authority also operates 22 car storage yards. The location and acreage of each is shown in Figure 3. In addition, the Authority also operates over 30 Maintenance of Way shops located throughout the system, see Figure 4.

Most of the Car Maintenance shops and barns are in a deteriorated condition, have inefficient layouts and provide inadequate space to support effective maintenance practices. Since it is not generally feasible to build new car shops and barns, the existing facilities must be upgraded. The Maintenance of Way shops are also in a deteriorated condition and do not provide adequate space. Depending on their condition, these shops are to be either replaced or up-graded.

The Five Year Program proposes a comprehensive program to completely modernize both main shops and all 13 barns located throughout the system. Some of the barn work will include: blow-out facilities, upgrading of 600 V.D.C. power systems, roof replacement, upgrading of pit lighting, upgrading of overhead lighting, toilet/showerroom/lockerroom facilities, improved and expanded storage facilities, air conditioning inspection facilities and equipment replacement. The work at the main shops, in addition to some of the above, will include new Air Brake facilities, Electronic and Electrical Repair facilities, shop extensions and shop equipment.

Also included in the Five Year Program is the replacement, modernization and/or rehabilitation of several Maintenance of Way Shops. Some of the shops to be upgraded are: Bridge Street Line Equipment shop, new iron works shop, new diesel repair facilities, second floor at 207th Street battery shop and new air conditioning repair shops.

As far as the 22 car storage yards are concerned, they have never undergone a comprehensive rehabilitation program and they are easily accessible hereby allowing vandals to deface and damage car equipment. In addition, operational flexibility and the number of cars stored in several yards is limited due to lack of sufficient tracks.

The Five Year Program calls for the complete rehabilitation of 6 yards (East New York, Fresh Pond, Jamaica, Pitkin, E. 180th Street and Corona). This rehabilitation will include track, contact rail, power and signals. In addition, since some components in some yards cannot wait for a complete yard rehabilitation, selected individual yard components will be rehabilitated such as contact rail in 5 yards, power distribution facilities in 1 yard, hydrant system in 1 yard and lighting in 3 yards.

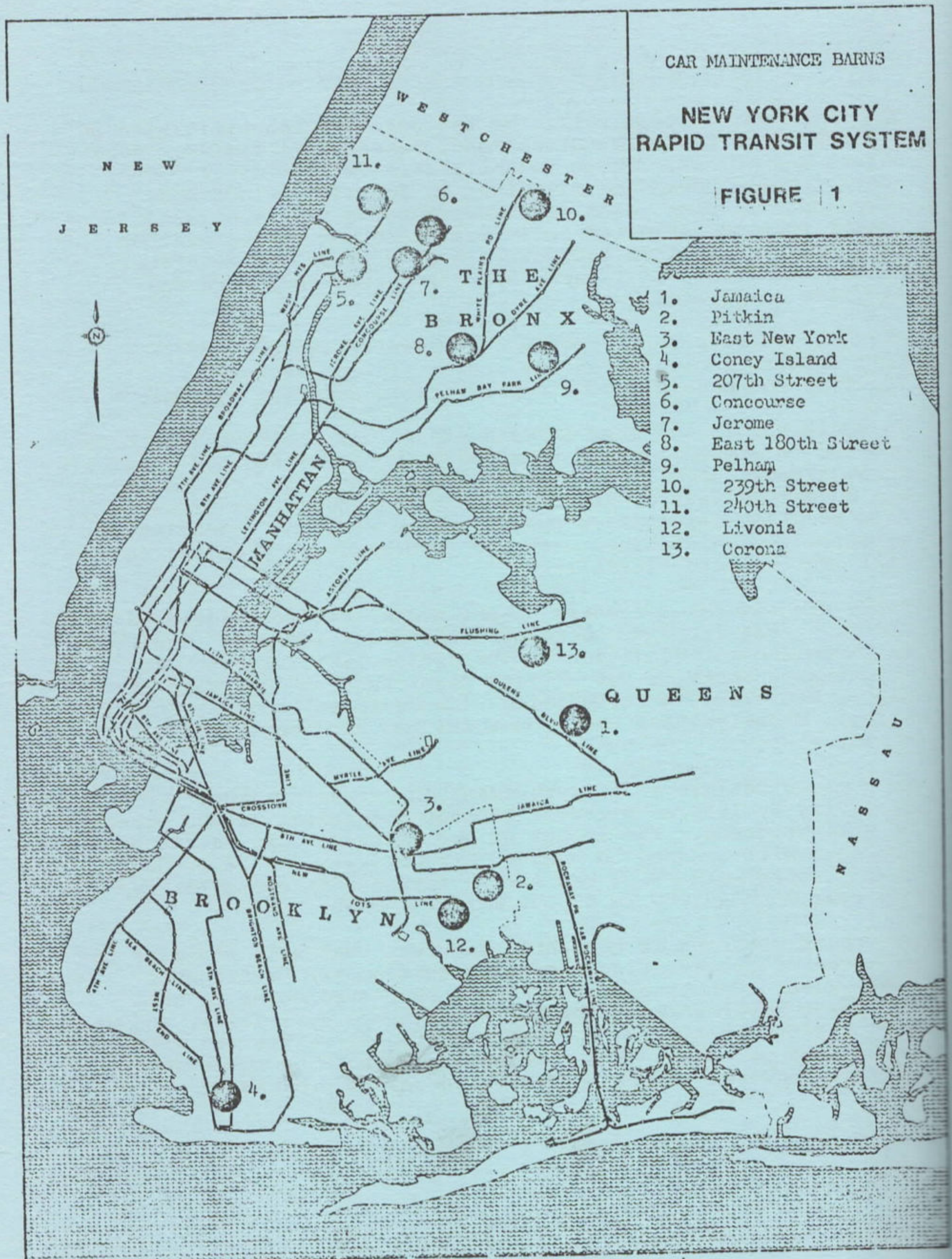
Also in the Five Year Program are security improvements. This program includes fencing, razor ribbon, improved lighting and possibly some sophisticated security systems.

In addition, in the area of yard expansion, the Five Year Plan propses to expand 3 yards (Stillwell, Coney Island and Jamaica). These expansions will eliminate the need to store trains on the Queens Boulevard, Brighton, West End and Culver Lines. This program will improve operations by reducing vandalism, especially when conbined with the yard security program, and will improve yard flexibility.

There are several currently un-met needs that are addressed to the Five Year Program. Some of these needs include: undercar blow-out and air conditioning inspection facilities at Car Maintenance barns, a new unified Maintenance of Way Yard at Linden Boulevard, a new unified Line Equipment shop at Bridge Street, Brooklyn, and new iron-works and air conditioning repair shops.

We hope to realize a 7% improvement in Car Maintenance productivity by 1990 as a result of shop modernization and other related programs. The amount of car miles per Car Maintenance employee will be used to measure productivity. A 7% productivity improvement will require an increase in car miles per employee from 40,000 to 43,000 miles by 1990.

Extensive planning is currently underway that will minimize the problems of construction impacting ongoing car maintenance activities. Construction work will be phased so as to have the least adverse impact on Car Maintenance activities, and we will reschedule some car work to additional shifts and work seven days per week. The combination of both of these should minimize adverse affects in our maintenance programs.


CAR MAINTENANCE BARNS
NEW YORK CITY
RAPID TRANSIT SYSTEM
FIGURE 1
1. Jamaica
2. Pitkin
3. East New York
4. Coney Island
5. 207th Street
6. Concourse
7. Jerome
8. East 180th Street
9. Pelham
10. 239th Street
11. 240th Street
12. Livonia
13. Corona
NEW JERSEY
WESTCHESTER
THE BRONX
MANHATTAN
QUEENS
BROOKLYN
NASSAU
FLUSHING LINE
JAMAICA LINE
MYRTLE AVE LINE
CROSSTOWN
8TH AVE LINE
PELHAM BAY PARK LINE
BRIGHTON BEACH LINE
SEA BEACH LINE

INSPECTION BARNS

Barns	Division	# Cars Assigned
Corona	A	409
Jamaica	B	754
Pelham	A	430
Coney Island	B	1,290
Jerome	A	395
East New York	B	658
240 Street	A	608
180 Street	A	794
Pitkin	B	973
	TOTAL	6,311

TROUBLE BARNS

Name	Division
Livonia	A
Concouse	B
239th Street	A
207th Street	B

MAIN SHOPS

Name	Division
Coney Island	B
207th Street	A

Figure 2

YARDS

Location	Division	Area (acres)
Manhattan		
207th Street	B	43.57
148th Street (Lenox)	A	8.48
138th-144th Street*	A	4.57
174th Street*	B	2.11
Brooklyn		
Coney Island and Culver	B	67.00
Stillwell Avenue	B	7.32
East New York	B	11.18
Rockaway Park	B	10.28
Pitkin	B	23.63
Livonia	A	7.75
38th Street	B	43.94
Queens		
Fresh Pond	B	8.99
Corona	A	14.82
Jamaica	B	25.15
Rockaway Parkway	B	11.11
Bronx		
East 180th Street	A	7.90
Concourse	B	23.07
240th Street	A	11.62
239th Street	A	20.35
Jerome	A	7.10
Westchester (Pelham)	A	29.79

* Underground yards

MAINTENANCE OF WAY SHOPS

Structures Division		Unionport Road Bergen Street 14th Street
Track Division		Linden Shop Westchester Yard 38th Street Yard
Signals Division		207th Street Yard (215th Street) 14th Street
Line Equipment Division		
	Turnstiles -	99th Street, 14th Street, 7th Avenue (Brooklyn)
	Ventilation & Drainage -	Sands Street, City Hall, 44th Street, 8th Avenue, Broadway-Lafayette
	Elevator and - Escalator	Dyckman Street
	Lighting -	Stillwell Avenue, Atlantic Avenue, Myrtle-Wyckoff Avenue, Queens Plaza, 14th Street, Times Square, Grand Central, 168th Street, 149th-Concourse, 99th Street-3rd Avenue
Power Dist. & Spec. Equip		148th Stret-Lenox Avenue, Bergen Street, 38th Street Yard, Park Place, Linden Shop, Westchester Yard

Figure 4

SHOP PROGRAM

The Long Island Rail Road has shops for maintaining electric and diesel cars at several locations. However, many of these shops were constructed before the turn of the century. At the present time, diesel cars are serviced outdoors at Richmond Hill for lack of an enclosed facility. Morris Park Shops, which were constructed in the 1890s, serve as the locomotive inspection/repair facility as well as the main shop facility for both the diesel and electric commuter cars (Exhibit 1). It is proposed that a major program be initiated for upgrading and modernizing equipment maintenance facilities in accordance with the LIRR Maintenance Facilities Master Plan Study.

The Long Island Rail Road currently maintains over 1,200 units of rolling stock consisting of electric passenger cars, diesel-hauled passenger cars, diesel locomotives and power generator units at 19th century facilities that were initially constructed for maintaining steam locomotives and smaller passenger coaches. As rolling stock was acquired, changes were made in the layout within constraints of the physical plant to adapt the facility for maintaining diesel locomotives and electric M-1 cars in addition to diesel-hauled passenger cars.

The MTA Capital Program calls for purchasing 216 M-3 cars. The existing shops cannot adequately handle today's car fleet. A modern Shop Complex would be used to maintain both diesel and electric equipment serving our 295,000 daily passengers. If a new shop complex is not constructed, the cars will continue to be poorly maintained, resulting in train malfunctions and passenger discomfort.

The recommendations of the Master Plan include multiple phases of construction to be accomplished without interfering with on-going car maintenance (Exhibit 2).

The Five Year Capital Program completes funding for Phases 1-4. A separate program will be undertaken simultaneously with Phases 1 and 2 which will relocate the present Maintenance of Way and Stores Departments from Holban Yard to permit the construction of a periodic inspection facility for electric cars.

PHASE 1

Diesel Hauled Car Service and Inspection Shop
Rehabilitation of Richmond Hill Storage Yard

Phase 1 - Richmond Hill Yard and Maintenance Facilities will be a total renewal of this location, including a new shop to permit maintenance of vehicles indoors, new welfare facilities, and a number of associated yard improvements. The result will be a modern, up-to-date shop and yard facility with improved working conditions and fully in conformance with environmental and safety standards.

These improvements will include a new shop building capable of housing eight vehicles. It has two car spots on each of four tracks. Flexibility is designed into this facility such that it will have the current ability to maintain diesel-hauled cars and will have the flexibility in the future for maintenance of married pairs of MU electric cars. The shop has two two-car spots with truck and body hoists to permit lifting of the car body so that trucks and axles and other undercar equipment can be maintained or removed from the car for replacement. There are also two two-car tracks with pits--one of those two tracks has a platform to permit access into the car at floor height for interior and exterior car work. A 15-ton travelling overhead crane will be provided for lifting of trucks and undercar components in the area where the truck and body hoists are located. Also provided in the building is a service area which includes parts storage and support facilities such as foremen offices, welfare facilities, and provision for special service department support facilities that are currently in temporary trailers on the site.

The new facility will meet all federal requirements for the handicapped employee access as well as OSHA safety requirements.

On one side of the shop building, a covered platform four cars long to be used for extraordinary interior cleaning on the passenger coaches. A new fuel oil storage and dispensing system will be provided throughout the yard, as well as lube oil storage and dispensing systems to the various track locations where lube oil is required. A yard lighting system will be provided--none now exists. The lighting will improve security in the yard and improve safety for any yard operations that occur at night. The areas between tracks will be concrete, and pollution control provisions will be provided to contain fuel/lube oil spills. Oil separation and grease separation will also be provided for yard drainage so that effluent from the yard can be drained into the sewer system. The site improvements will also include new fire protection and water services throughout the yard and security fencing. Staged construction will be implemented so that current operations at Richmond Hill will be maintained during the improvements program.

PHASE 2

Car Storage Across 89th Avenue, New Paint Shop, New Storage Facility, and other Morris Park Improvements

There will be several improvements to the Morris Park Facility in Phase 2. An area owned by the LIRR across 89th Avenue north of Morris Park will be converted to a secured car storage area. Six tracks will be provided with space for a total of 18 married pairs of M-1 cars. The lead from the Montauk Branch to Morris Park will be maintained and if necessary, realigned to accommodate the new storage tracks. This part of Phase 2 also includes fencing and lighting of the "Y"-shaped yards (Exhibit 4).

A new paint shop will be constructed in this Phase 2 in the area currently occupied by the wheel truing facility. A retaining wall along the Montauk Branch will be necessary and the two tracks adjacent to the wheel truing building will be moved closer to the Montauk so that a new wheel truing facility can be constructed adjacent to the existing one (Exhibits 5 and 6).

The new Paint Shop will then be built on the south side of the new Wheel Truing Building, providing two lines, one for M-1 painting and one for diesel-hauled coach and locomotive painting. The paint shop will improve the overall appearance of the entire car fleet, most notably, the diesel fleet. Existing painting facilities do not conform to environmental standards. The locker and washroom building used by locomotive engineers; the bridge and building department headquarters; and the inspection crew building will be removed in preparation of the site for the Paint Shop construction. Temporary facilities will be provided for these groups in this phase until permanent facilities are available in a later phase.

Trackwork connecting the Wheel Truing Building and Paint Shop to existing tracks will be constructed. Entrance to both lines of the Paint Shop will be at the east end. In this phase only the M-1 line will have a "run through" track. The DHC and locomotive line will be stub-ended at the west end of the shop until Phase 10 when space for a connecting track will be available. A portion of the northeast corner of the Engine House will be removed for the connecting track from the M-1 line. A new end wall would then be placed on the Engine House and any affected building systems modified.

Access to one of the inspection pits east of the turntable will be eliminated, requiring a new inspection pit to be provided.

Electrification necesary for operation of the Wheel Truing Building, Paint Shop, and Storage Yard will be supplied.

A new waste treatment facility for Morris Park and Richmond Hill will also be constructed in this phase in the area between the leads to the turntable and the Paint Shop. The waste treatment

facility will be sized and configured to handle all waste from Morris Park in both the short and long-terms (Exhibit 7).

A new storage facility will be integrated with the existing Storage Building and Component Shops Buildings. This will provide covered shipping and receiving areas. The gasoline pumps must be relocated for this phase. The exterior of the main office building at the entrance to Morris Park will be renovated and the second and third floors will be remodeled consistent with the modifications made on the main floor (Exhibits 8 and 9).

New Air Plants will be built in the vicinity of Jamaica Station to provide air for the interlockings controlled by Jay, Hall and Dunton Towers.

Any paving, curbing, and site work related to any of the work of Phase 2 will be completed.

PHASE 3

New Electric Car Shop

Phase 3 is the construction of a new Electric Car Shop in the northwest corner of Morris Park. The shop will have nine married pair positions, including two pair positions with truck and body hoists for truck and component changeout. The facility will also contain new Upholstery, Air-Conditioning Repair, Switch Group/ Jumper/Contactor Overhaul, and Electronic Shops (Exhibits 10-13).

Construction of this shop will eliminate access to the north end of the west transfer table. Therefore, a track must be provided through the Car Shop Building so that access to the west transfer table can be made from the east transfer table. Approximately 100 feet at the north end of the Car Shop Building also must be removed. This section of the building will be unused upon completion of the new Paint Shop in Phase 2. A new end wall would be constructed on the building and utilities would have to be modified to maintain building systems.

The placement of trackwork for the new Electric Car Shop will necessitate the removal of the two northmost bays of the existing Diesel Locomotive Shop and the Lunch, Locker, and Washroom Building. A new end wall would be constructed on the existing Diesel Shop and the building systems modified to maintain operation in the remainder of the building. In order to accommodate the locomotive overhaul and major repair operations, the two small pits in the Locomotive Shop will be extended to the same length as the longer pits, providng five tracks with full pits. New partitioning will be required around the Electronic Component Repair Shop and the equipment maintenance group storeroom to provide access around the ends of the pits. The material currently in the Storehouse Building will be moved into the Storehouse constructed in Phase 2. The old Storehouse building will then be converted to a Welfare Facility for the forces using the Washroom Building. The lube oil storage tank and two small metal buildings located north of the Welfare Facility storing propane and fuses will also be relocated.

The trackwork will provide access to all bays of the new shop from the tracks north of the Wheel Truing Building, and also connect the new shop to the west end of the M-1 line in the new Paint Shop. Access to the north end of the east transfer table as well as the car storage area across 89th Avenue must be maintained. Third rail electrification will be provided where necessary.

All paving, curbing, and sitework related to this phase, including the extension of the roadway along the west edge of the site north to 89th Avenue will be completed.

PHASE 4

New Locomotive Service and Inspection Facility
(Exhibits 14 and 15)

In Phase 4, new locomotive servicing and inspection facilities will be built in the Advance and Receiving Yards. All facilities will be in the same area with one building housing the service and daily inspection operations in the Advance Yard and the repair operations in the Receiving Yard.

Two tracks will be constructed to bypass the building on both the north and south side. The tracks on the north side will require building approximately 600 linear feet of retaining wall, about 26 feet in height, along the property line on the south side of 92nd Avenue. A portion of the EIC platform must also be removed. Retaining walls will be required along the south side of the Receiving Yard, and between the Advance and Receiving Yard.

Access to 92nd Avenue will be provided from the lower level of the facility, under the two run-around tracks.

The existing turntable at Richmond Hill will be rehabilitated for use as part of the facility. Modification of the existing tracks in both yards will provide ingress and egress to the facility and storage for locomotives. Access to the Richmond Hill DHC S&I facility must be maintained during construction.

The car wash facility in the Advance Yard will be relocated to one of the run-around tracks, which must be electrified for M-1 use.

The Trainmen's Welfare Building will be demolished and new facilities for trainmen, hostlers, engineers and yardmaster will be provided on the second floor of the new locomotive service and PI facility.

Lighting and communication systems will be provided as needed in the yard.

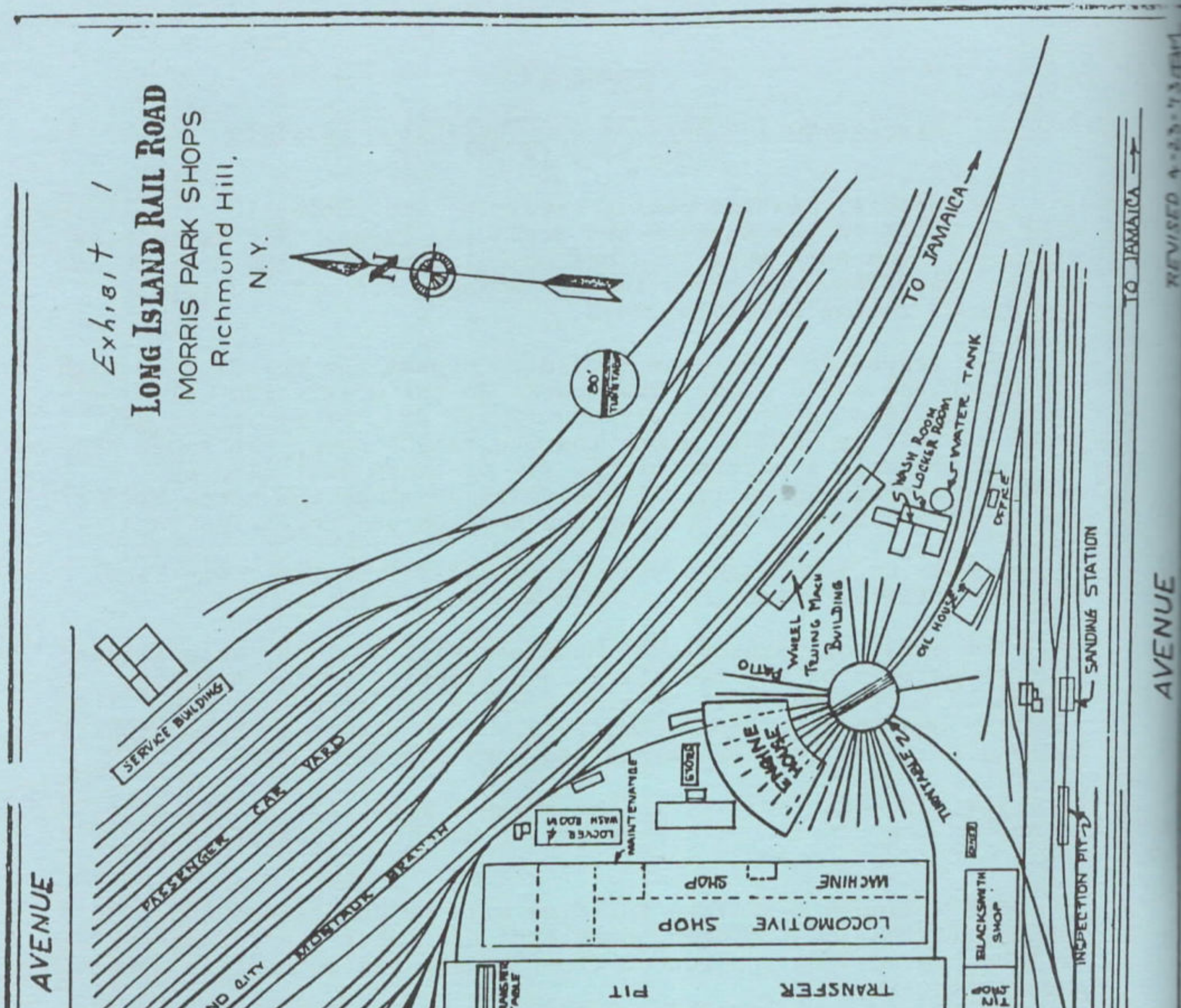
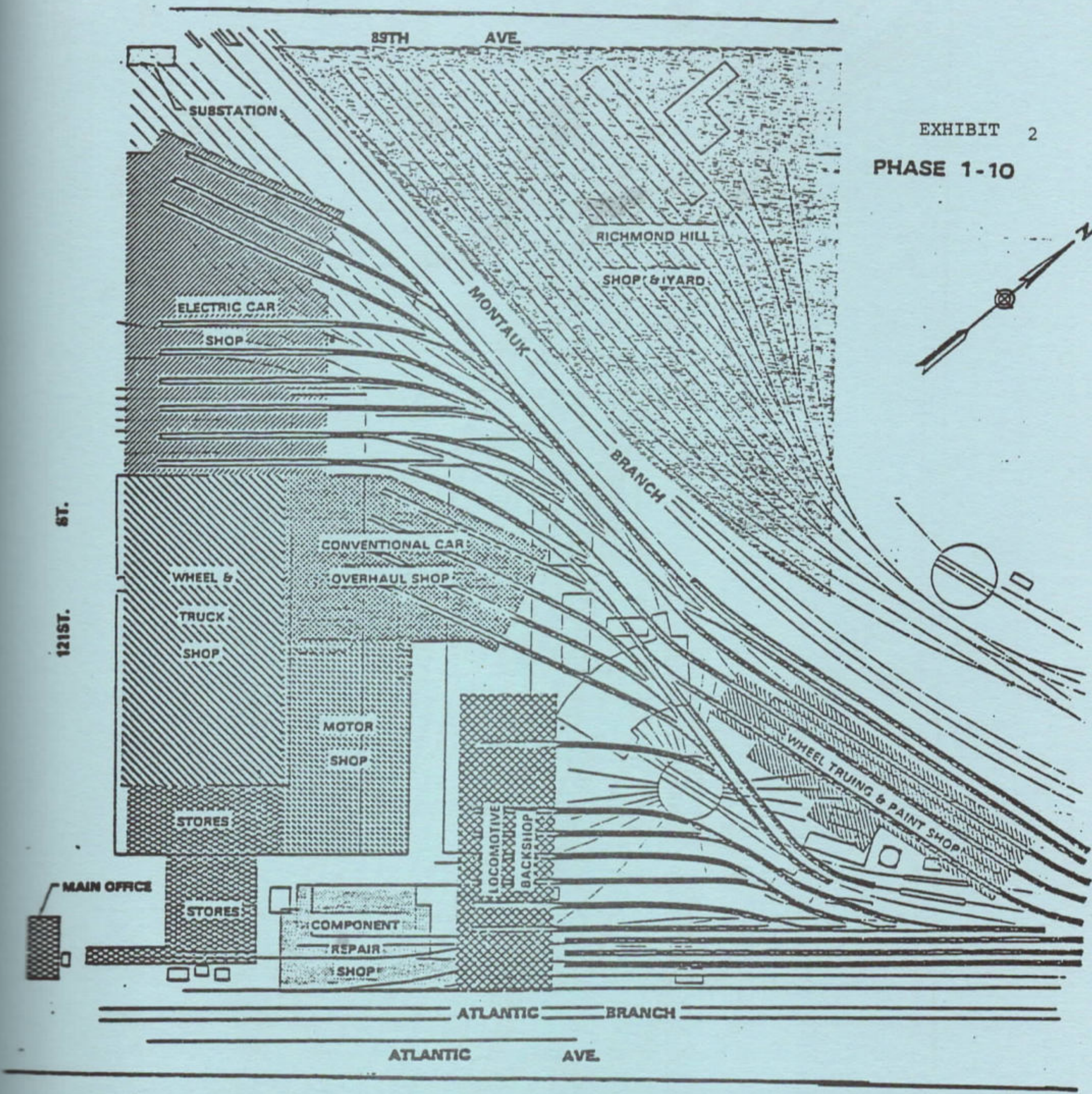


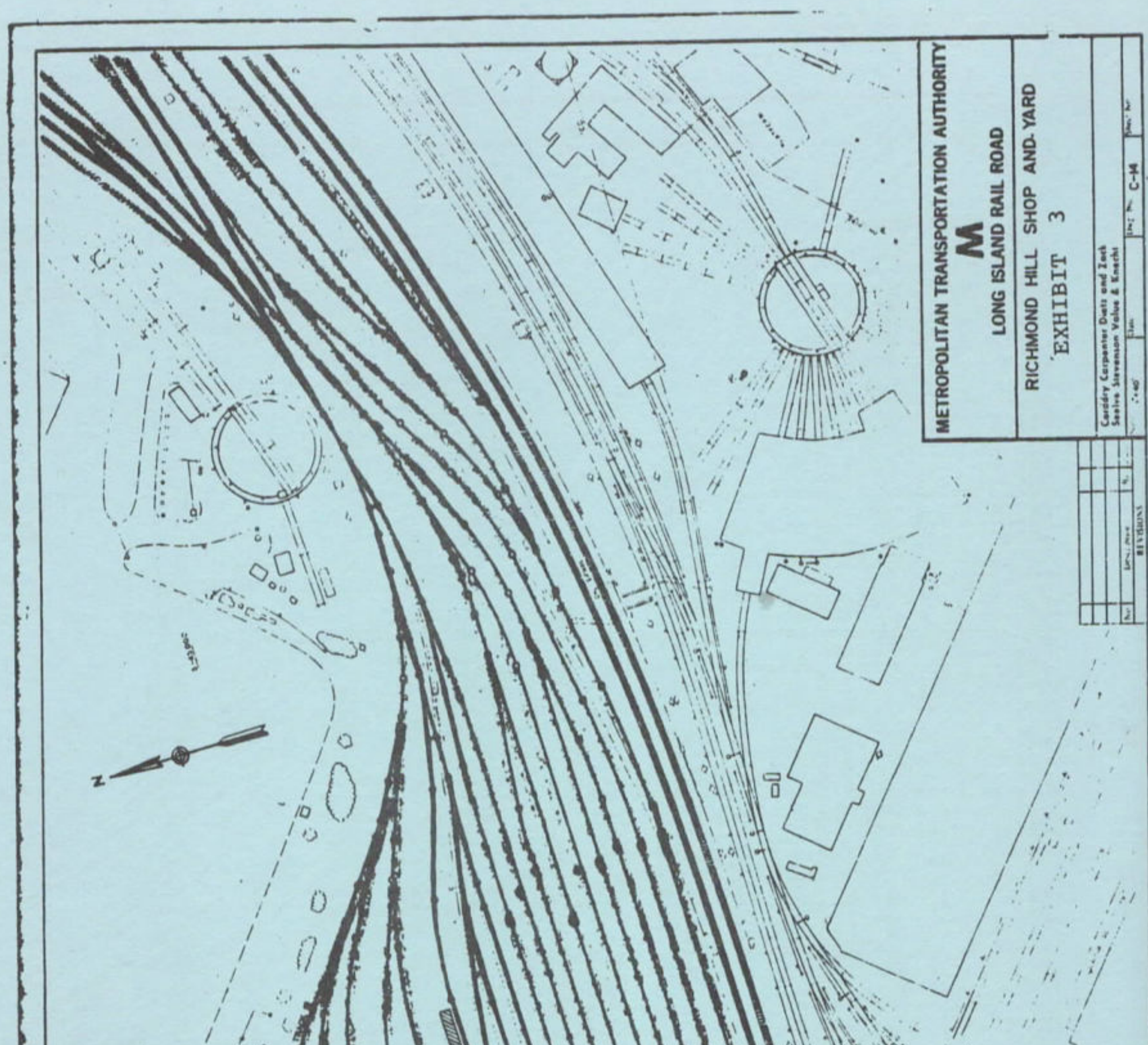
Exhibit 1
LONG ISLAND RAIL ROAD
MORRIS PARK SHOPS
Richmond Hill,
N.Y.
N
80' TURNTABLE
TO JAMAICA
SERVICE BUILDING
PASSENGER CAR YARD
TO LONG ISLAND CITY
MONTAUK BRANCH
SHOP YARD
WASH ROOM
LOCKER ROOM
WATER TANK
OFFICE
WHEEL TRUING MACH BUILDING
PATIO
OIL HOUSE
ENGINE HOUSE
TURNTABLE
STORE
LOCKER & WASH ROOM
MAINTENANCE
MACHINE SHOP
LOCOMOTIVE SHOP
TRANSFER TABLE
TRANSFER PIT
PAINT SHOP
CAR SHOP
TRANSFER PIT
WHEEL STORAGE
ELECTRIC CAR TRUCK SHOP
CRANE SHOP
ELECTRIC CAR SHOP
BST. FL. ELEC. MOTOR SHOP
2ND FL. UPHOLSTRY & MILL WORK
3RD FL. AIR BRAKE SHOP
COMPRESS. ROOMS
BLACKSMITH SHOP
TIN SHOP
STEAM PLANT
STORE HOUSE
GROUND STORAGE
MAIN OFFICE
INSPECTION PIT
SANDING STATION
TO JAMAICA
AVENUE
ATLANTIC AVENUE
89TH AVENUE
STREET
121ST
91ST AVE.
REVISED 4-23-73

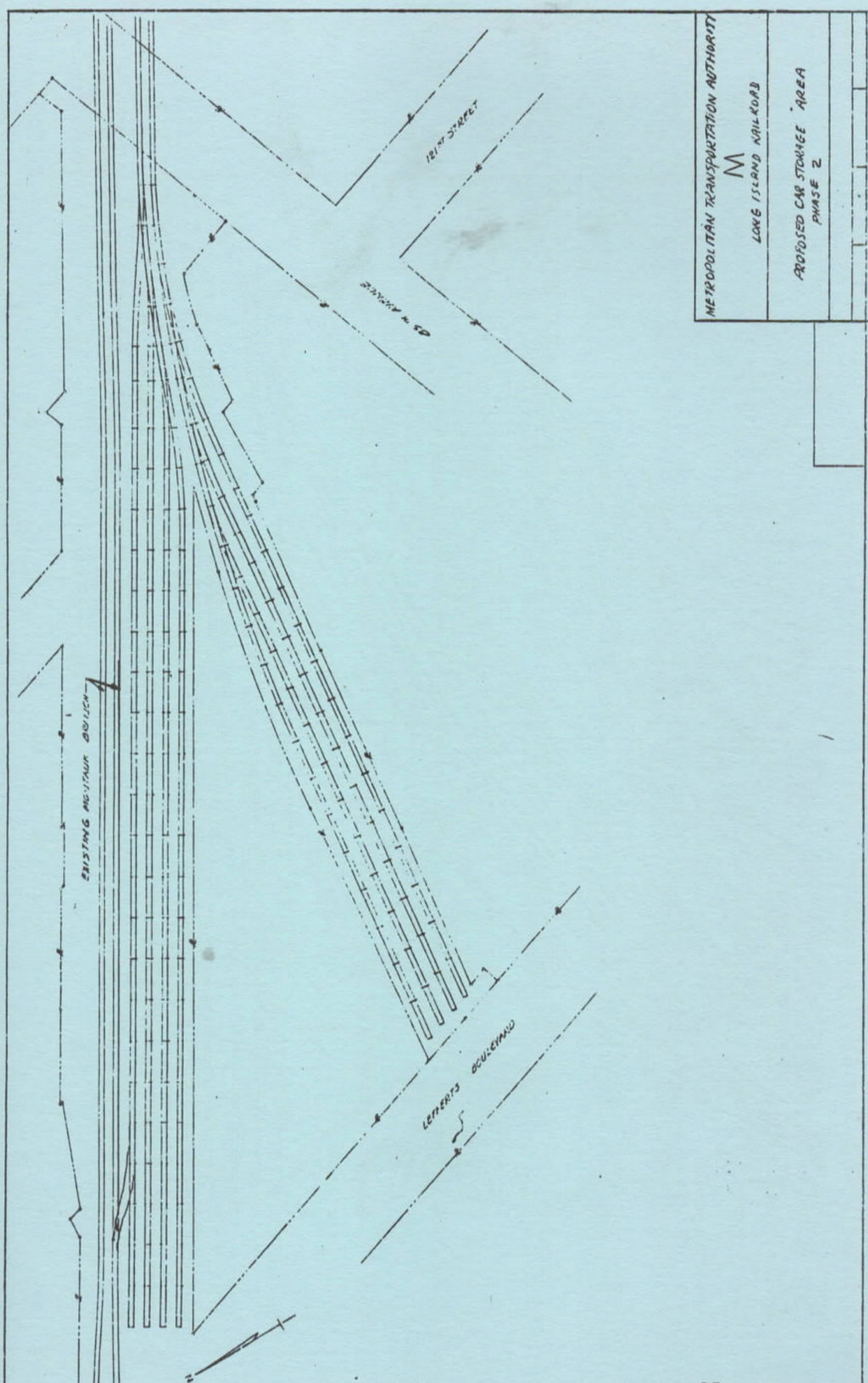
EXHIBIT 2

PHASE 1-10



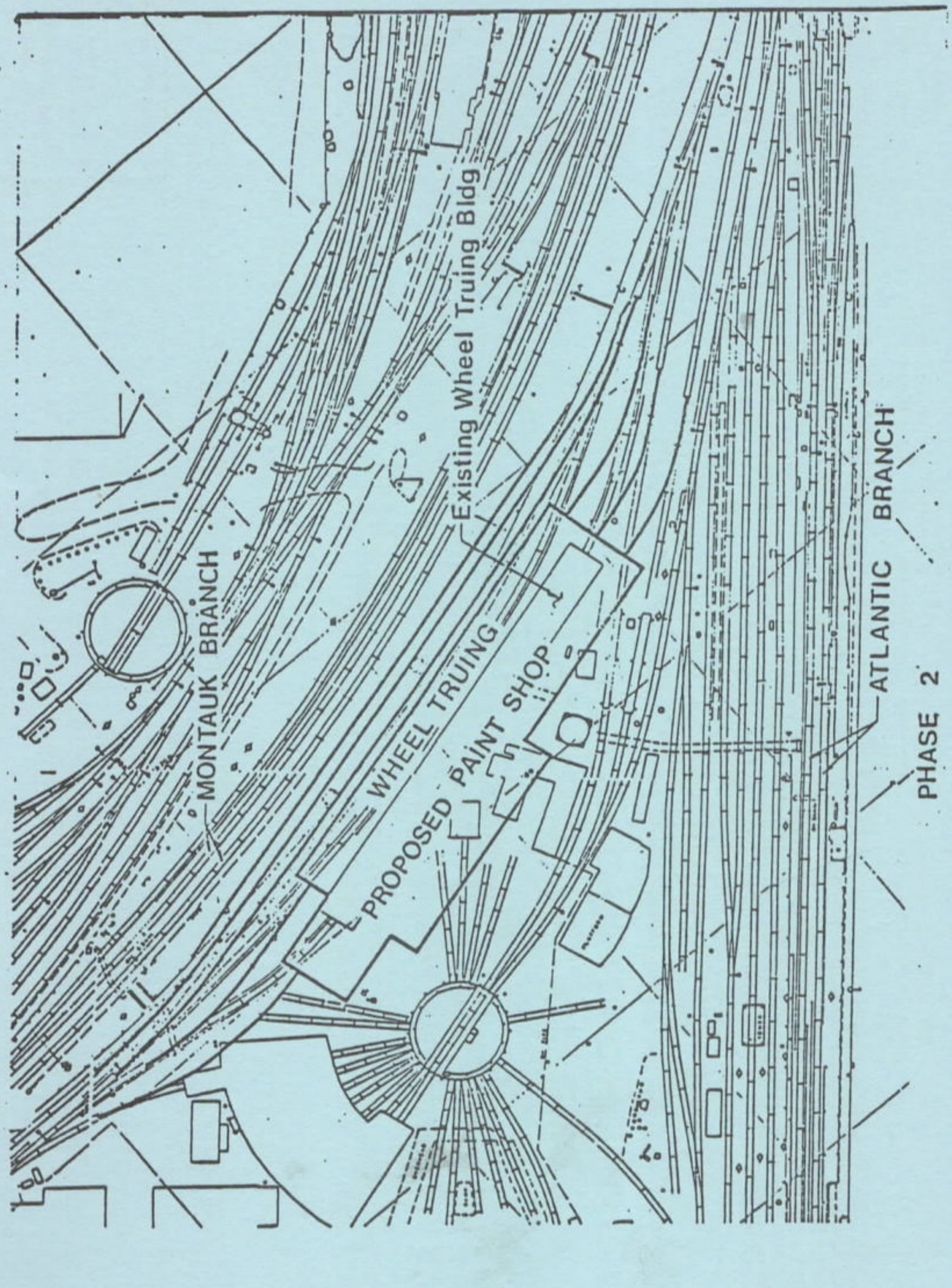
PHASED MAINTENANCE OF EQUIPMENT
FACILITIES IMPROVEMENTS

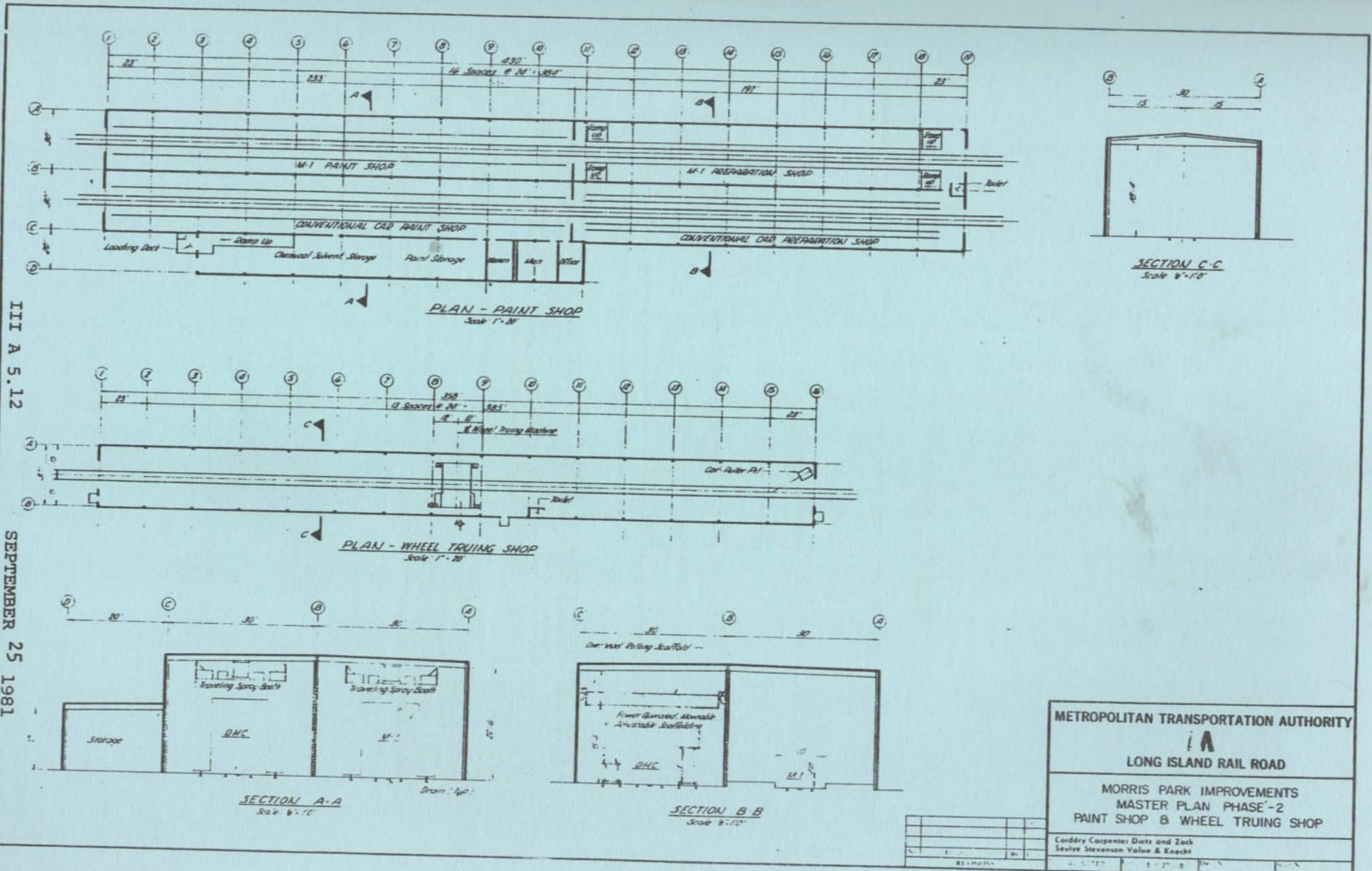

METROPOLITAN TRANSPORTATION AUTHORITY
M
LONG ISLAND RAIL ROAD
RICHMOND HILL SHOP AND YARD
EXHIBIT 3
PROPOSED SHOP
PROPOSED SUPPORT FACILITY
N



SEPTEMBER 25, 1981

EXHIBIT 5

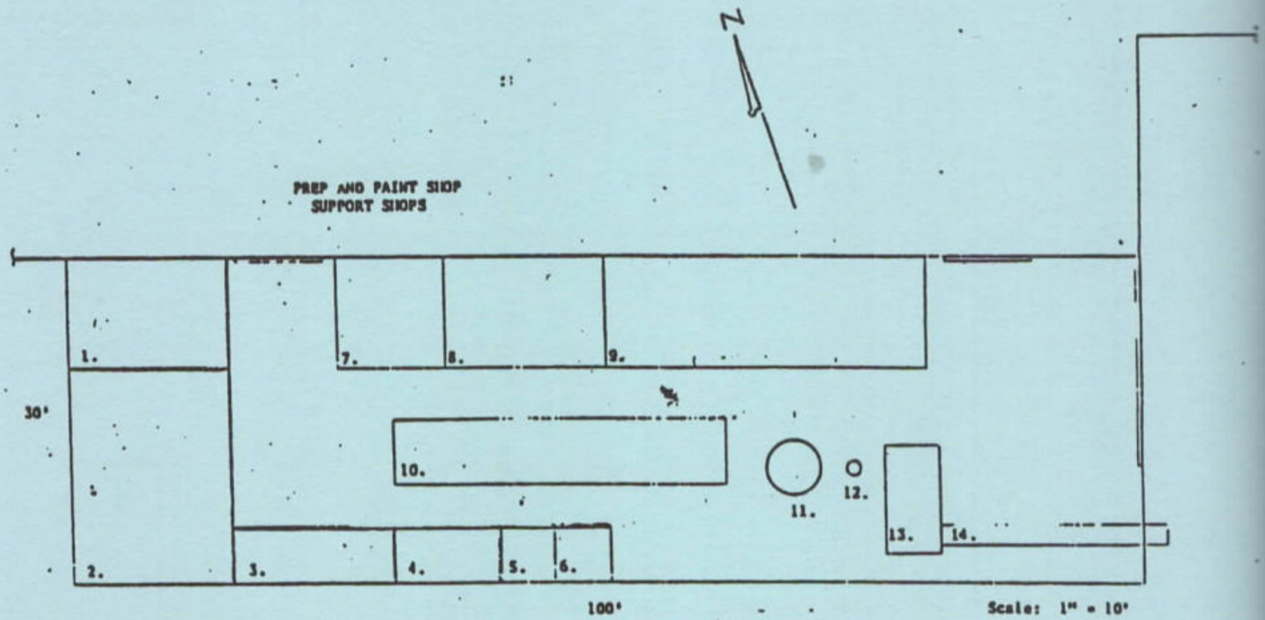

Existing Wheel Truing Bldg
MONTAUK BRANCH
WHEEL TRUING
PROPOSED PAINT SHOP
ATLANTIC BRANCH
PHASE 2



PLAN - PAINT SHOP
M-1 PAINT SHOP
M-1 PREPARATION SHOP
CONVENTIONAL CAR PAINT SHOP
CONVENTIONAL CAR PREPARATION SHOP
Loading Dock
Ramp Up
Chemical Solvent Storage
Paint Storage
Men
Toilet
PLAN - WHEEL TRUING SHOP
Wheel Truing Machine
Car Puller
Toilet
SECTION A-A
Traveling Spray Booth
Storage
SECTION B-B
Over head Rolling Scaffold
SECTION C-C
METROPOLITAN TRANSPORTATION AUTHORITY
LONG ISLAND RAIL ROAD
MORRIS PARK IMPROVEMENTS
MASTER PLAN PHASE-2
PAINT SHOP & WHEEL TRUING SHOP
Corddry Carpenter Dietz and Zack
Sevige Stevenson Value & Knecht

EXHIBIT 6

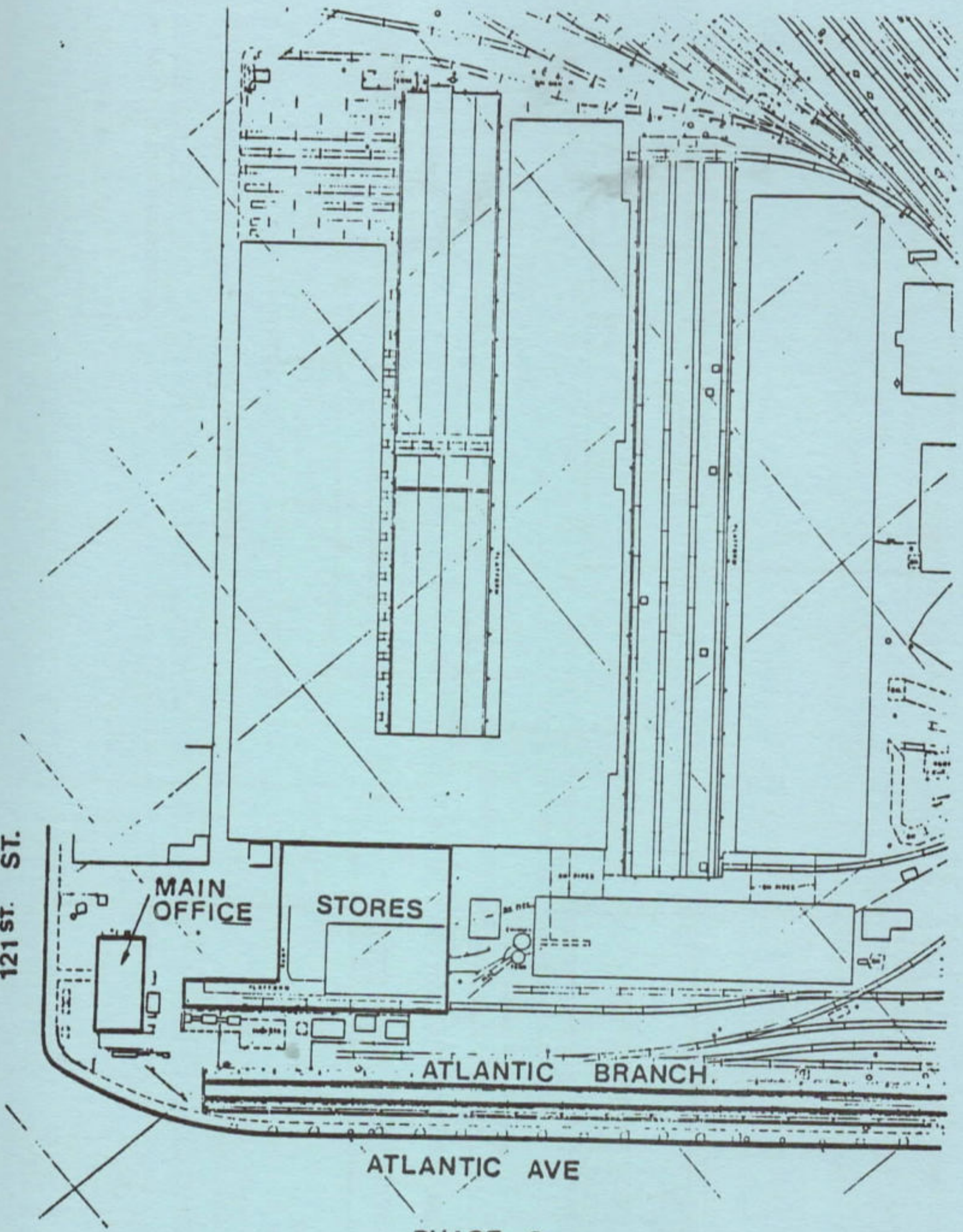
EXHIBIT 7



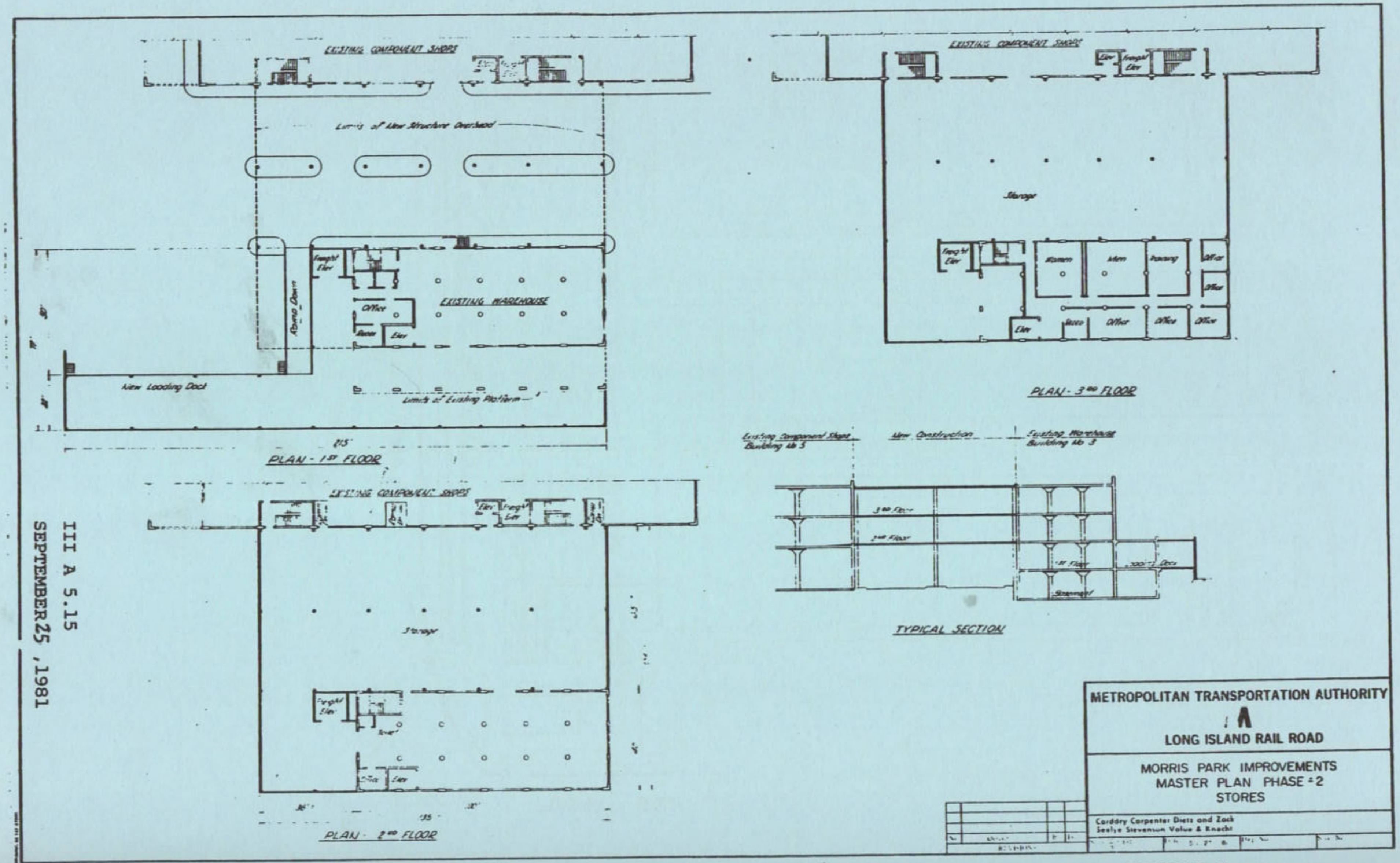
Legend

1. Paint Shop Process Wastewater Holding Tank (10'w x 15'l x 10'd; 11,250 gallons; Below-Grade)
2. Truck and Locomotive Washwater Underflow Holding Tank (20'w x 15'l x 10'd; 22,500 gallons; Below-Grade)
3. Alkaline and Vapor Degreasing Holding Tank (15'l x 5'w x 10'd); 5,625 gallons; Below-Grade)
4. Diesel Locomotive Shop Process Wastewater Holding Tank (10'l x 5'w x 10'd; 3,750 gallons; Below-Grade)
5. Battery Shop Process Wastewater Holding Tank (5'l x 5'w x 5'd; 950 gallons; Below-Grade)
6. Concentrated Oil Storage Tank (5' x 5'w x 5'd; 950 gallons; Below-Grade)
7. Office (10'l x 10'w)
8. Laboratory (10'l x 15'w)
9. Chemical Storage and Feeding Area (10'w x 30'l)
10. Package Physicochemical Treatment Plant (Above-Grade)
11. Sludge Thickener (Above-Grade)
12. Sludge Conditioning Basin (Above-Grade)
13. Sludge Dewatering Facility (Above-Grade)
14. Dewatered Sludge Conveyor Belt (Above-Grade)

Long Island Railroad
Morris Park Facility
Process Wastewater Pretreatment Plant
Proposed Layout

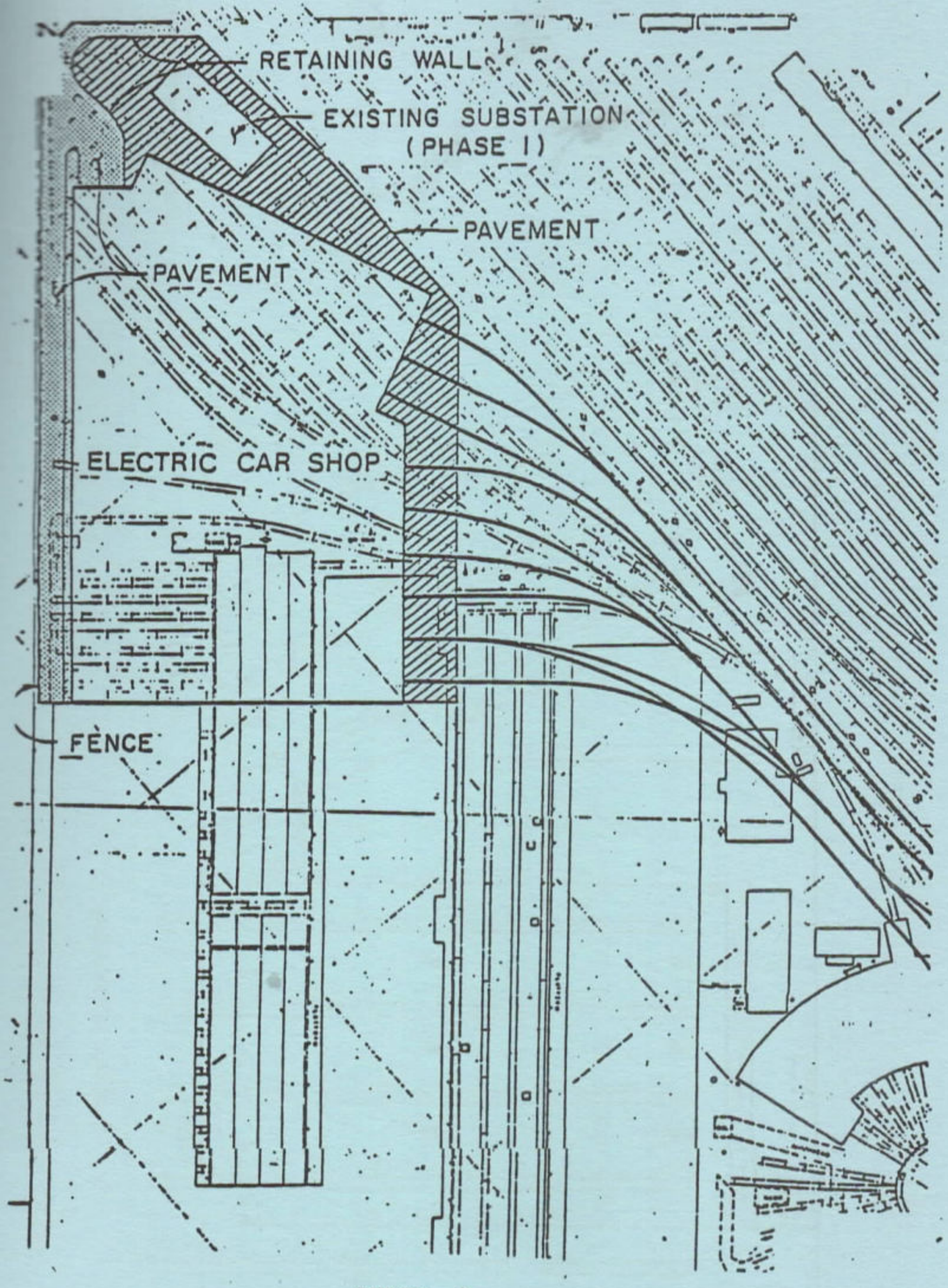


PHASE 2

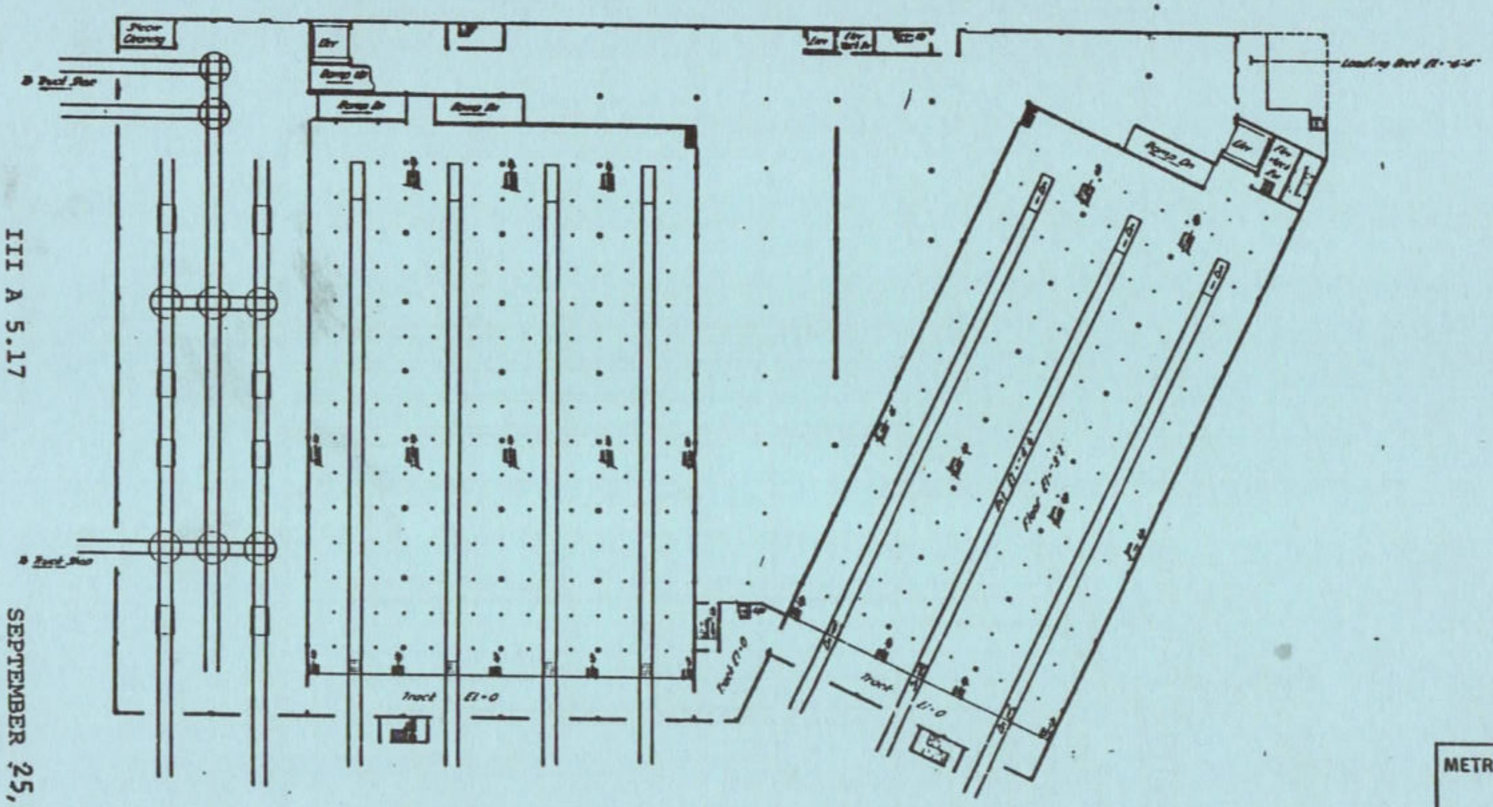


III A 5.15
SEPTEMBER 25, 1981

EXHIBIT 9


RETAINING WALL
EXISTING SUBSTATION
(PHASE I)
PAVEMENT
PAVEMENT
ELECTRIC CAR SHOP
FENCE

PHASE 3



PLAN - LOWER LEVEL

METROPOLITAN TRANSPORTATION AUTHORITY

LONG ISLAND RAIL ROAD

MORRIS PARK IMPROVEMENTS
MASTER PLAN PHASE - 3
ELECTRIC CAR SHOP

Corddry Carpenter Dietz and Zack
Sortyo Stevenson Volve & Knecht

EXHIBIT 11

SEPTEMBER 25,1981

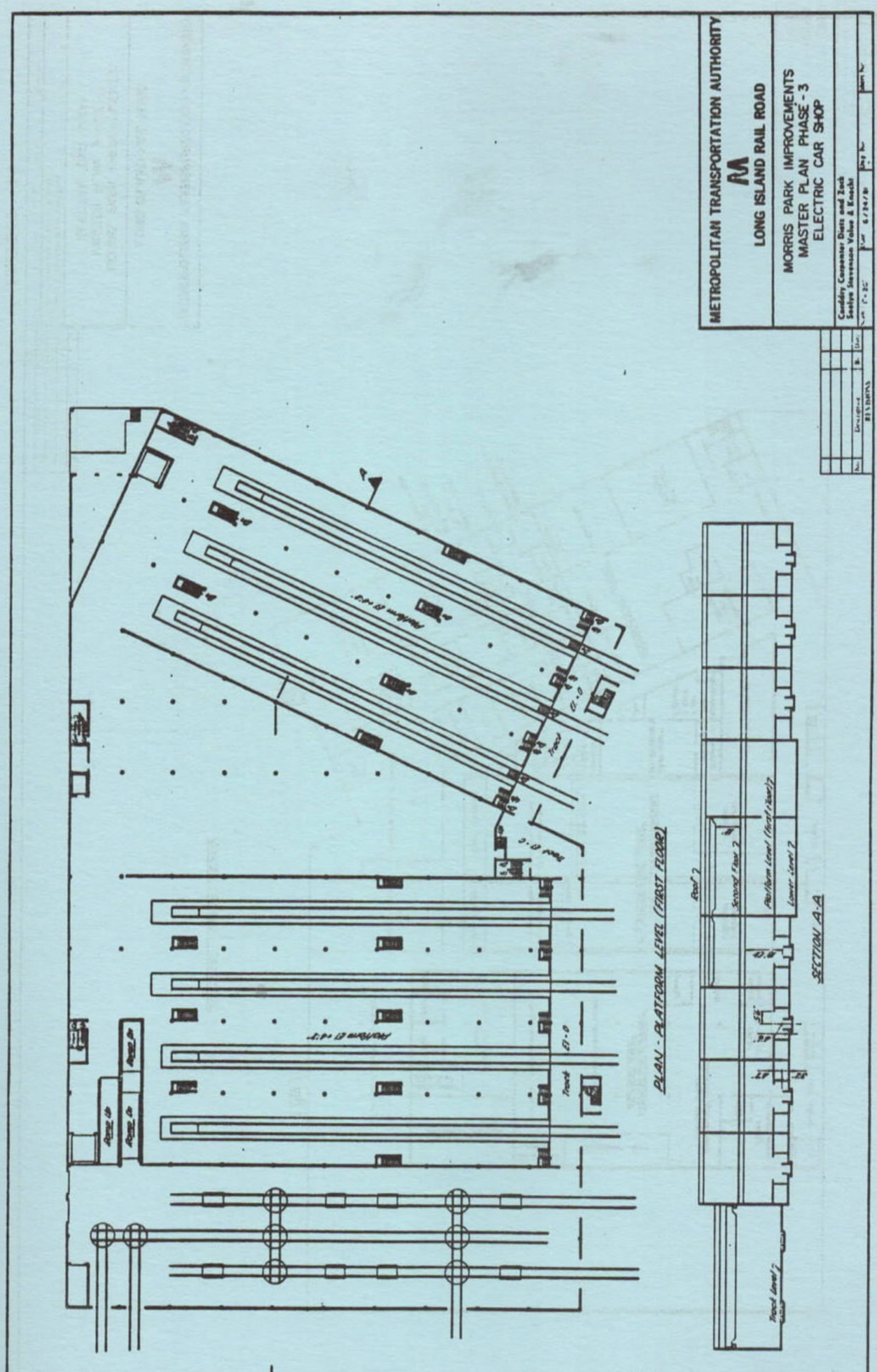
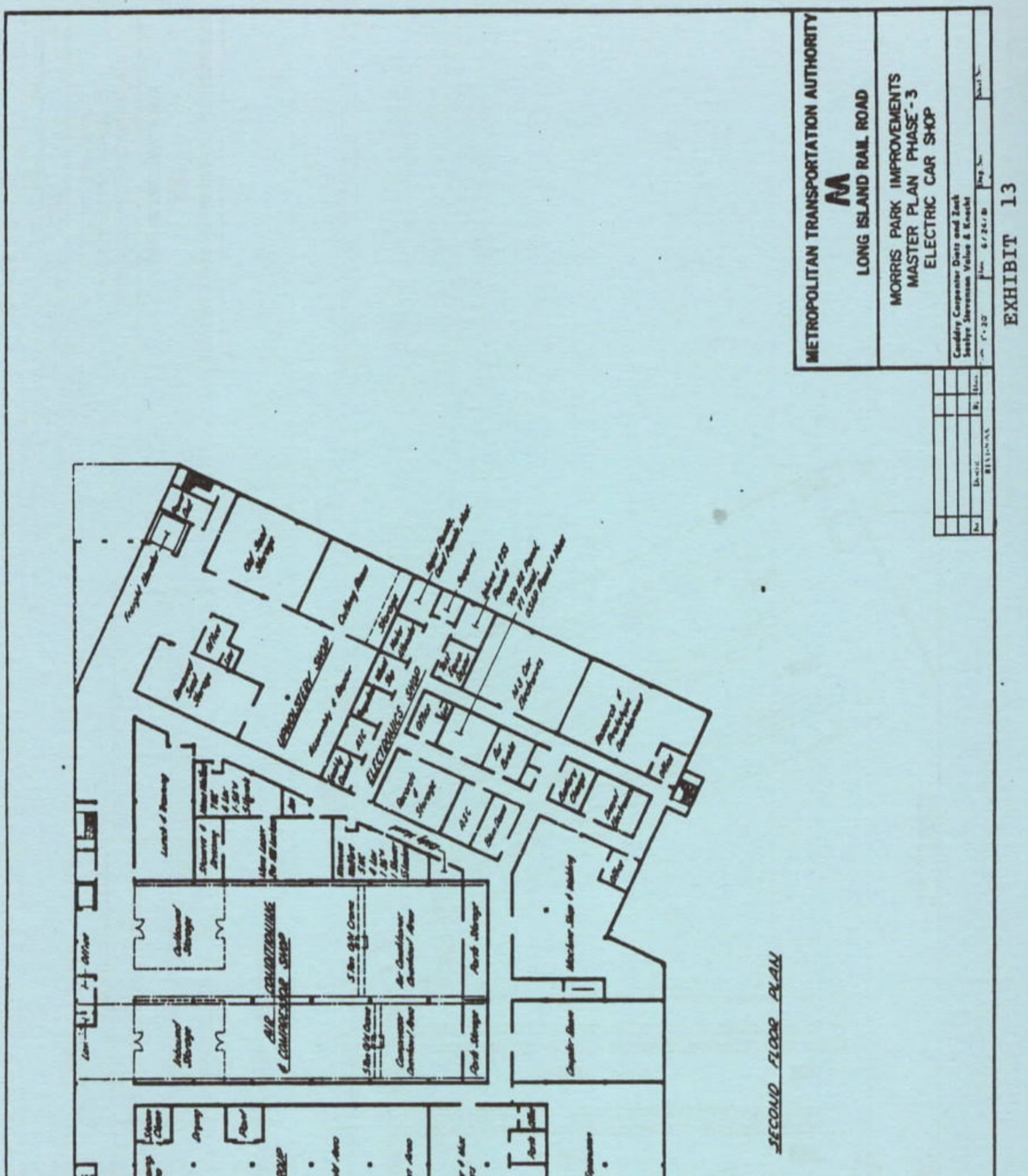
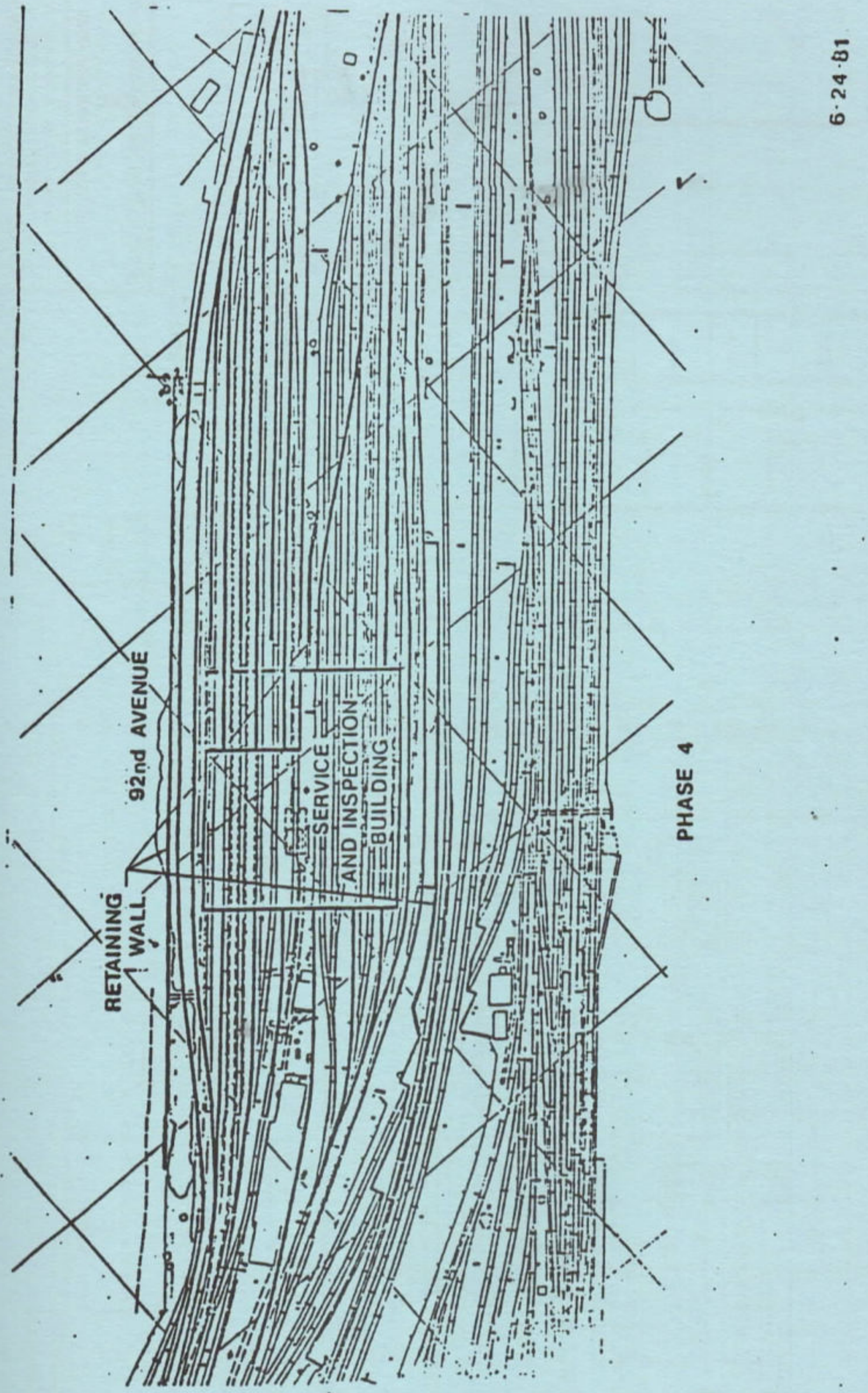

METROPOLITAN TRANSPORTATION AUTHORITY
LONG ISLAND RAIL ROAD
MORRIS PARK IMPROVEMENTS
MASTER PLAN PHASE - 3
ELECTRIC CAR SHOP
PLAN - PLATFORM LEVEL (FIRST FLOOR)
SECTION A-A
Roof
Second Floor
Platform Level (First Floor)
Lower Level
Track Level
Track
Ramp Up
Ramp Dn

EXHIBIT 12



SEPTEMBER 25 ,1981

EXHIBIT 14



6-24-81
92nd AVENUE
SERVICE
AND INSPECTION
BUILDING
RETAINING
WALL
PHASE 4

SEPTEMBER 25,1981

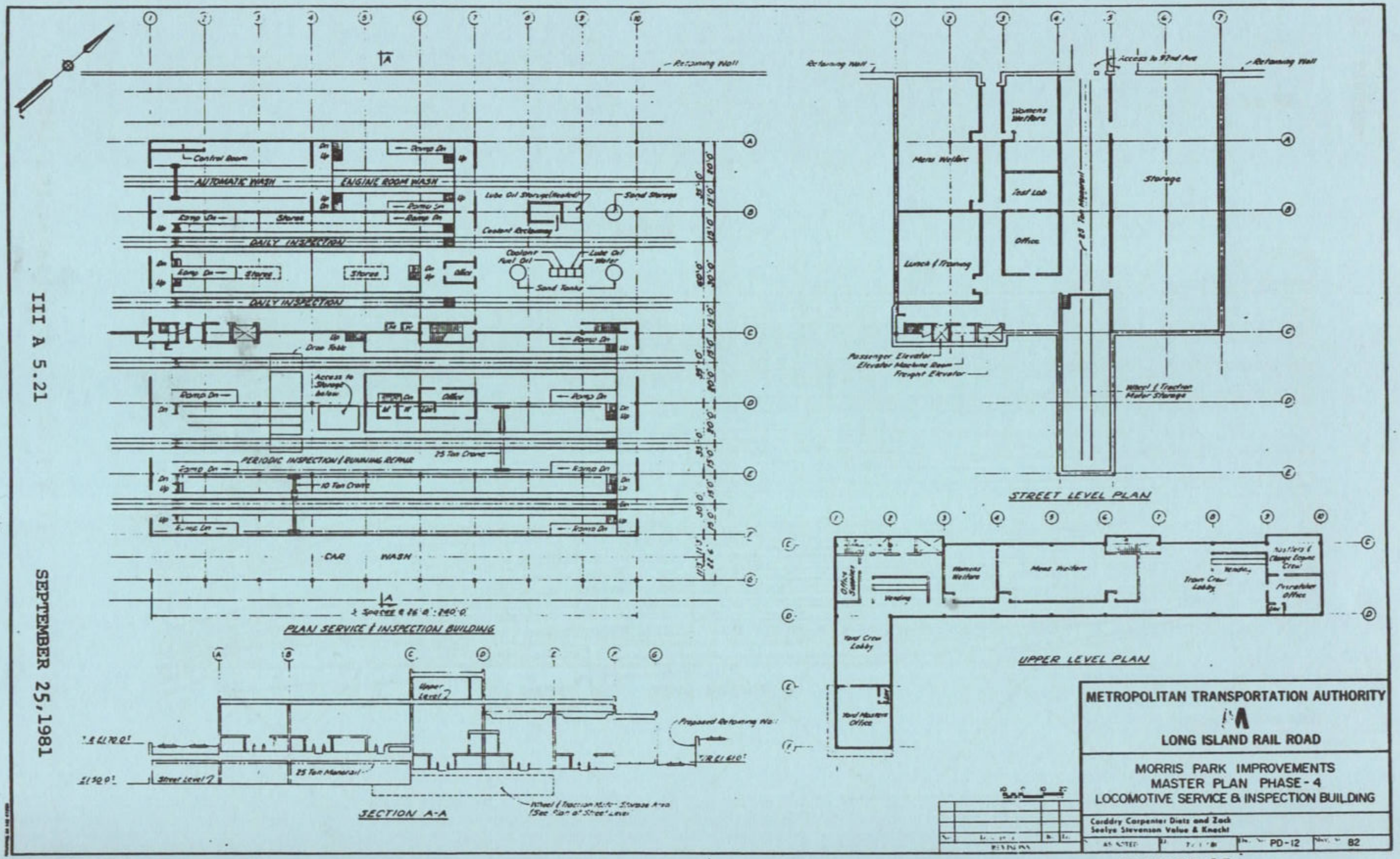


EXHIBIT 15

INFRASTRUCTURE REHABILITATION

The main elements of the infrastructure line rehabilitation consist of signals, track, structure and equipment projects. Significant portions of the system infrastructure have not been replaced or modernized since their original installation. The projected 5 year program will address many of the problems associated with this long term failure to provide the funds to upgrade and renew the system.

Many of these projects, require that work be done on or adjacent to operating tracks. Since the rapid transit system operates on a 24 hour a day basis, much of this work will require service disruption, single tracking, rerouting and delay of trains.

The increase in individual projects resulting from increased funding levels, necessitates and makes possible the packaging of individual projects into zone contracts wherein all major capital projects in a given area are done simultaneously under one contract.

The objective is to accomplish all required capital projects in a particular area at the same time. This will minimize disruption of service over extended periods of time and allow for greater overall efficiency.

The signal modernization projects will incorporate master signal towers. Under this concept new master signal towers will be constructed at central locations. Small sections of the transit system, formally controlled from several scattered towers, will be combined into large territories, each of which will be controlled from one master tower.

The projects in the zone contracts will result in a replacement ratio of one master tower for between 4 and 8 individual existing towers. These projects will increase productivity by decreasing the number of towermen required. Maintenance requirements will also decrease due to the smaller numbers of installations, and that new equipment will require less maintenance.

Generally the most expensive and controlling work in a zone contract is the signal modernization element. The priority for signal work largely determined the priority for the zone contracts. Other factors included the Authority's ability to program and design the work.

Once the basic signal modernization priorities were established, all necessary projects within or immediately adjacent to these areas were programmed to be included in the zone contracts.

Other high priority projects which are not in the zone contract areas will be progressed as rapidly as possible.

The non-zone contracts represent the major part of the infrastructure rehabilitation. The individual projects are generally spread around the system in a way that does not permit economical or operational advantages. No major signal modernization projects are programmed except as part of zone contracts. Individual projects include track and switch replacements, structural work, equipment, modernization, remedy of water problems and other projects which contribute to the infrastructure modernization.

The immediate goal of the rehabilitation contracts is to substantially increase system reliability and decrease maintenance efforts. These improvements, if not performed, could eventually lead to serious, long-term service interruptions and/or passenger delays, due to an increasing number of failures of the physical plant.

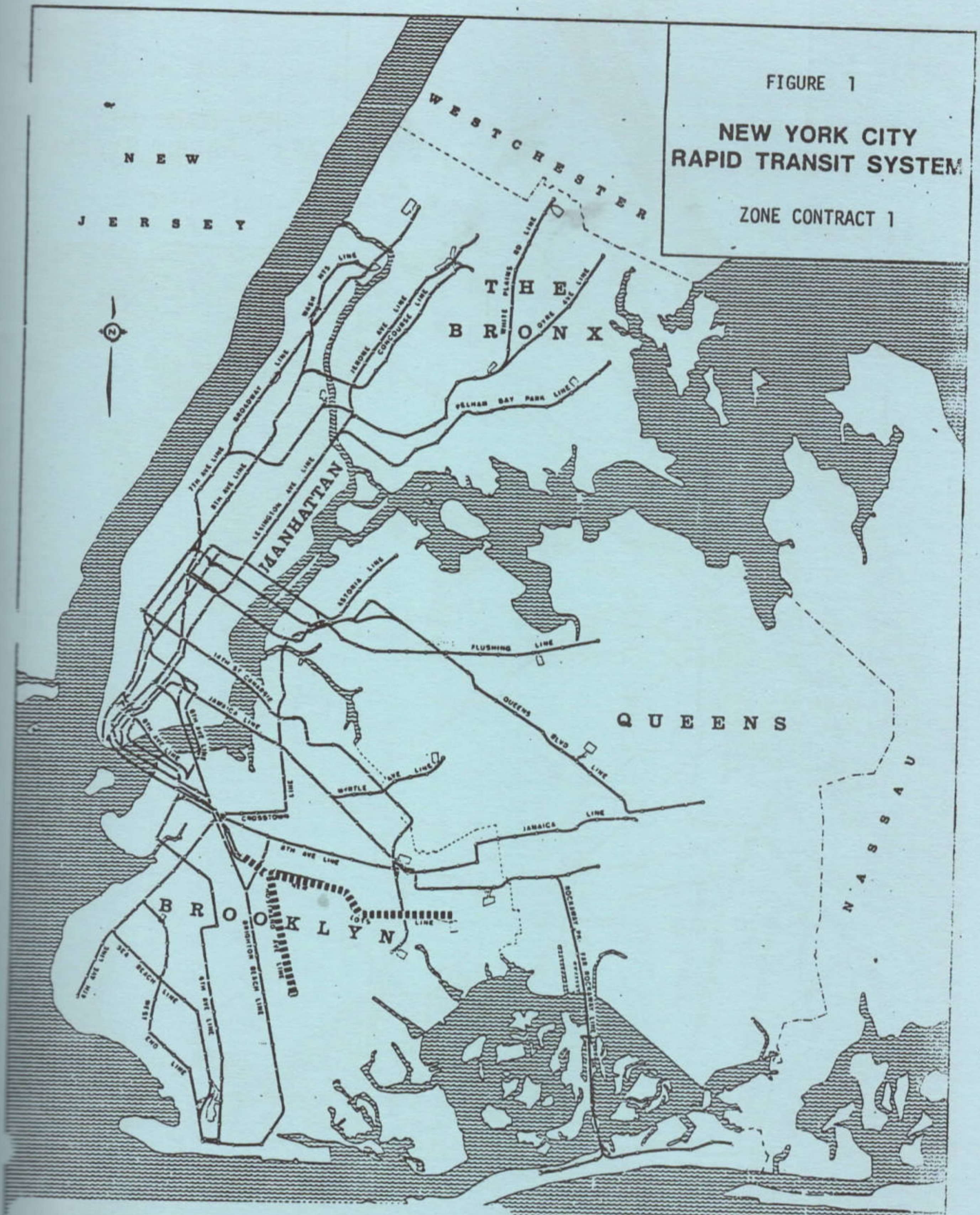
Acquisition of a sufficient number of steel wheeled service vehicles is included in the Five Year Program as they are required to advance this Program.

Attached are Figures 1, 2, 3, 4 showing the location of the zone contracts.

FIGURE 1

NEW YORK CITY RAPID TRANSIT SYSTEM

ZONE CONTRACT 1



BROOKLYN IRT
Hoyt to New Lots & All of Nostrand

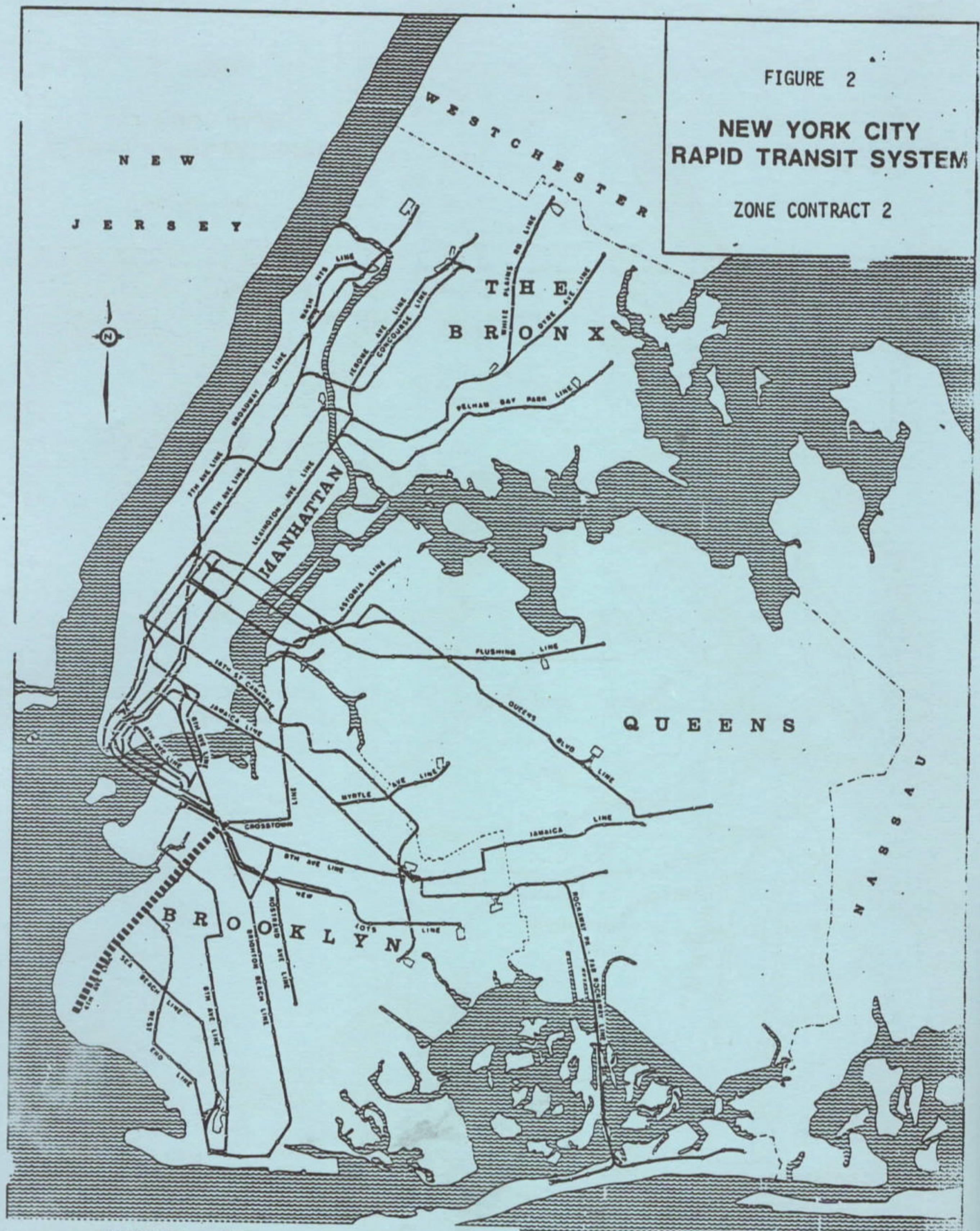


FIGURE 2

NEW YORK CITY RAPID TRANSIT SYSTEM

ZONE CONTRACT 2

BROOKLYN BMT
Fourth Ave. - Pacific to 95th Streets

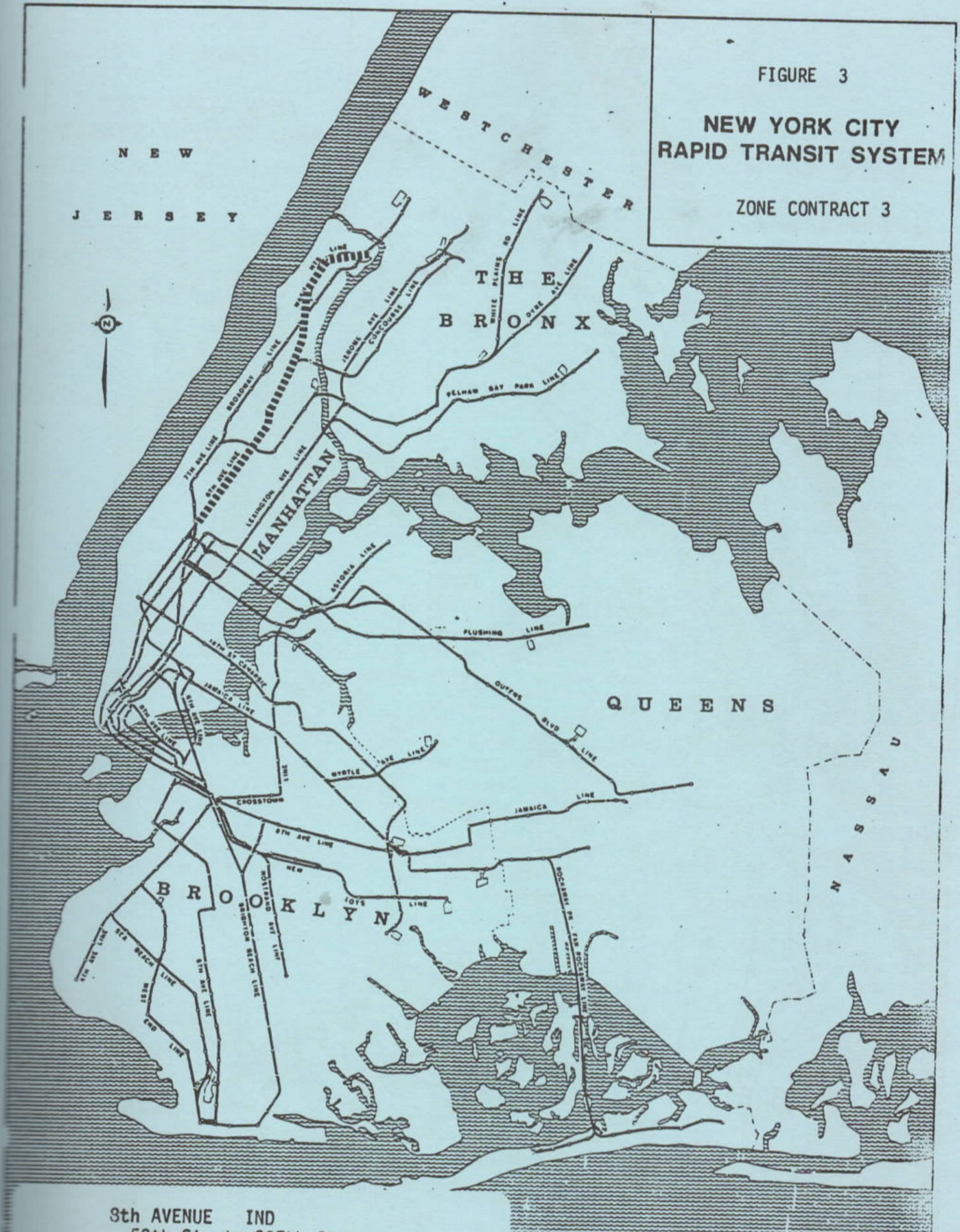


FIGURE 3
NEW YORK CITY
RAPID TRANSIT SYSTEM
ZONE CONTRACT 3
NEW
JERSEY
WESTCHESTER
THE
BRONX
MANHATTAN
QUEENS
BROOKLYN
NASSAU
BROADWAY LINE
7TH AVE LINE
8TH AVE LINE
LEXINGTON AVE LINE
JEROME AVE LINE
CONCOURSE LINE
WHITE PLAINS RD LINE
DYRE AVE LINE
PELHAM BAY PARK LINE
ASTORIA LINE
FLUSHING LINE
QUEENS BLVD LINE
JAMAICA LINE
MYRTLE AVE LINE
CROSSTOWN
NEW LOTS LINE
BRIGHTON BEACH LINE
SEA BEACH LINE
WEST END LINE
8th AVENUE IND
59th St. to 207th St.

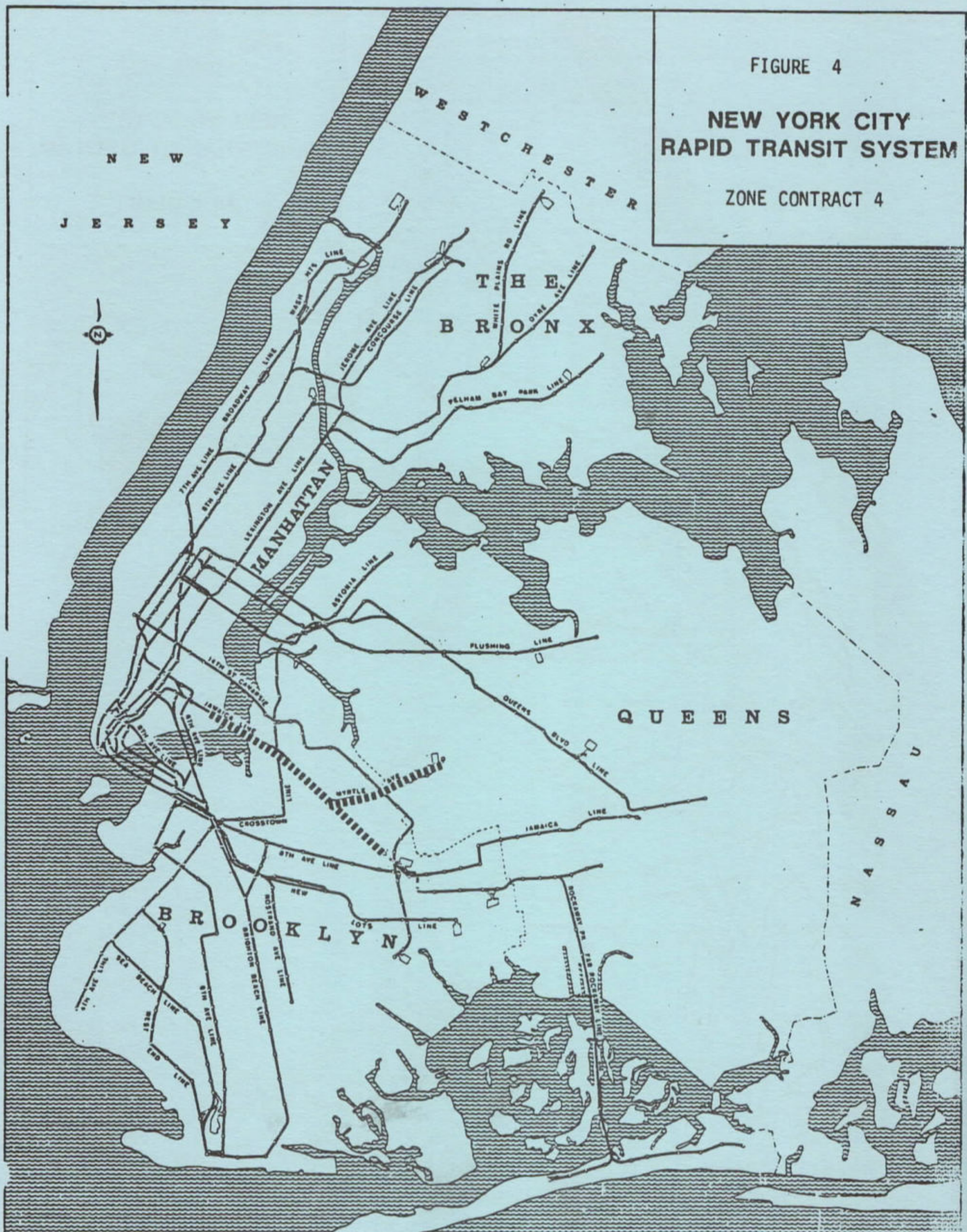


FIGURE 4

NEW YORK CITY RAPID TRANSIT SYSTEM

ZONE CONTRACT 4

JAMAICA LINE & MYRTLE LINE
Essex to Chauncey & All of Myrtle

September 25, 1981

Extension of LIRR Second Main Track

Port Jefferson and Ronkonkoma Branch

The major problem with a single main track is that service can only be provided in one direction at a time and if a problem occurs on the single track, all service in both directions must be curtailed until the problem is cleared up.

Port Jefferson Branch

The single track east of Syosset severely restricts operations on the Port Jefferson Branch, the LIRR's second largest branch (Exhibit 1). The railroad's second largest station, Huntington, is located 4-1/2 miles into the single track area. Ridership on the Port Jefferson Branch has increased 40% since 1973, and it is expected to continue this steady increase. A breakdown on the single track during the AM peak period affects passengers as far west as New Hyde Park, since equipment providing service to these stations originates in the single track area.

The additional track between AMOTT Interlocking at Syosset and Northport will result in both more reliable and increased service. It is the only service area today with mixed operations, MU and diesel trains on single track. This portion of track is the third most travelled on the LIRR, with over 900 cars and engines passing over it each day.

Fifteen westbound electric and diesel trains require the almost exclusive use of the single track Port Jefferson Branch during the AM rush hours. Only one morning eastbound train is scheduled east of Huntington; no eastbound trains arrive at Huntington for almost 2-1/2 hours from 6:08AM to 8:31 AM.

The increased operating flexibility provided by a two track line would make rush hour service more reliable for enabling the scheduling of trains on either or both tracks, when necessary. It would also enable eastbound morning rush hour trains to operate beyond Hicksville; this is virtually impossible with single track operation. A second track would eliminate problems inherent with single track operation and permit the smooth flow of equipment to and from Northport, resulting in improved passenger service for Port Jefferson Branch AM commuters. the frequency of service can be increased as well as providing service in reverse of the peak direction.

Today, there is no ability to serve reverse commuters at Port Jefferson and students at Stony Brook University and Hospital. In the morning, there is only one peak period train east of Huntington; there are none in the evening. (A four hour gap in westbound service exits from 4:00 PM to 8:00 AM on the diesel single track.)

A single track branch limits the railroad's effective use of its resources. Each train set able to double back could reduce MU car requirements. This has the potential to improve utilization of equipment and additional productivity savings occur because the crew also doubles back with the trains.

Ronkonkoma Branch

The 17 mile track segment between Republic and Ronkonkoma is the fastest growing branch on the railroad, with approximately 6,600 morning rush hour commuters. These improvements would allow more trains to be scheduled, operating at closer headways, and permit reverse commutation to Ronkonkoma.

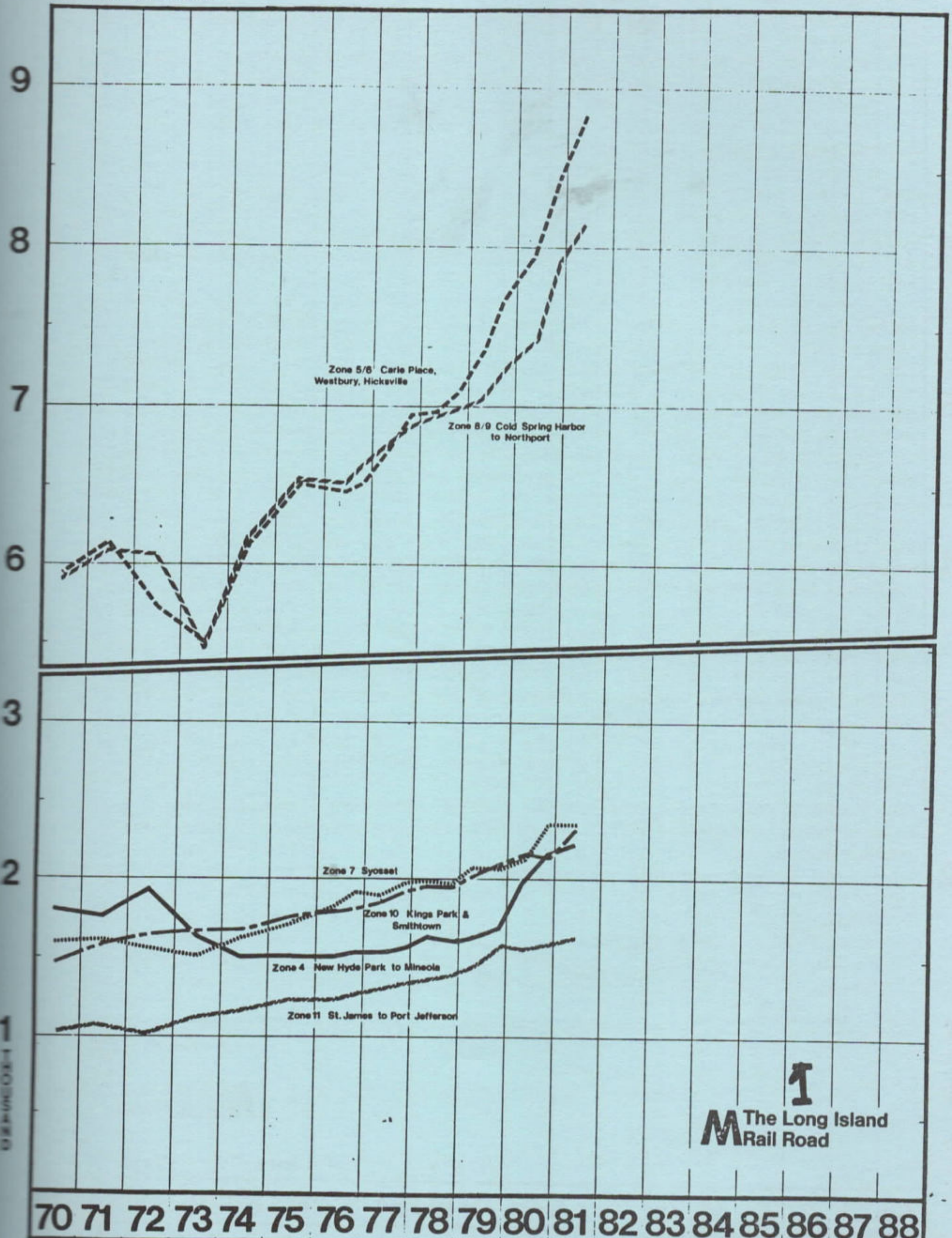
Ridership on this branch has increased by 62% since 1973 (Exhibit 2). Installation of the second track would be the initial step in improving service on this branch. This would allow more trains to be scheduled, to operate at much closer headways, and permit reverse commutation to Ronkonkoma. It would also be an important link to the proposed Ronkonkoma Transportation Hub. As on the Port Jefferson Branch, a breakdown on single track can close down the entire branch until the problem is cleared up, there is no way to get around a disabled train. There is virtually no reverse commuter service. The Ronkonkoma Branch serves the middle of the Long Island Corridor where much of the industry is located, and where job opportunities for reverse communtation already exist.

A second track would also improve equipment utilization locomotives, diesel cars and power units. The first five years of the Capital Program does not include an expansion of the diesel car fleet, making improved utilization even more important.

Construction of a second track would theoretically be terminated at any point west of Ronkonkoma. However, this would not be practical, since ridership growth is occurring at the easternmost stations, the stations most in need of additional service.

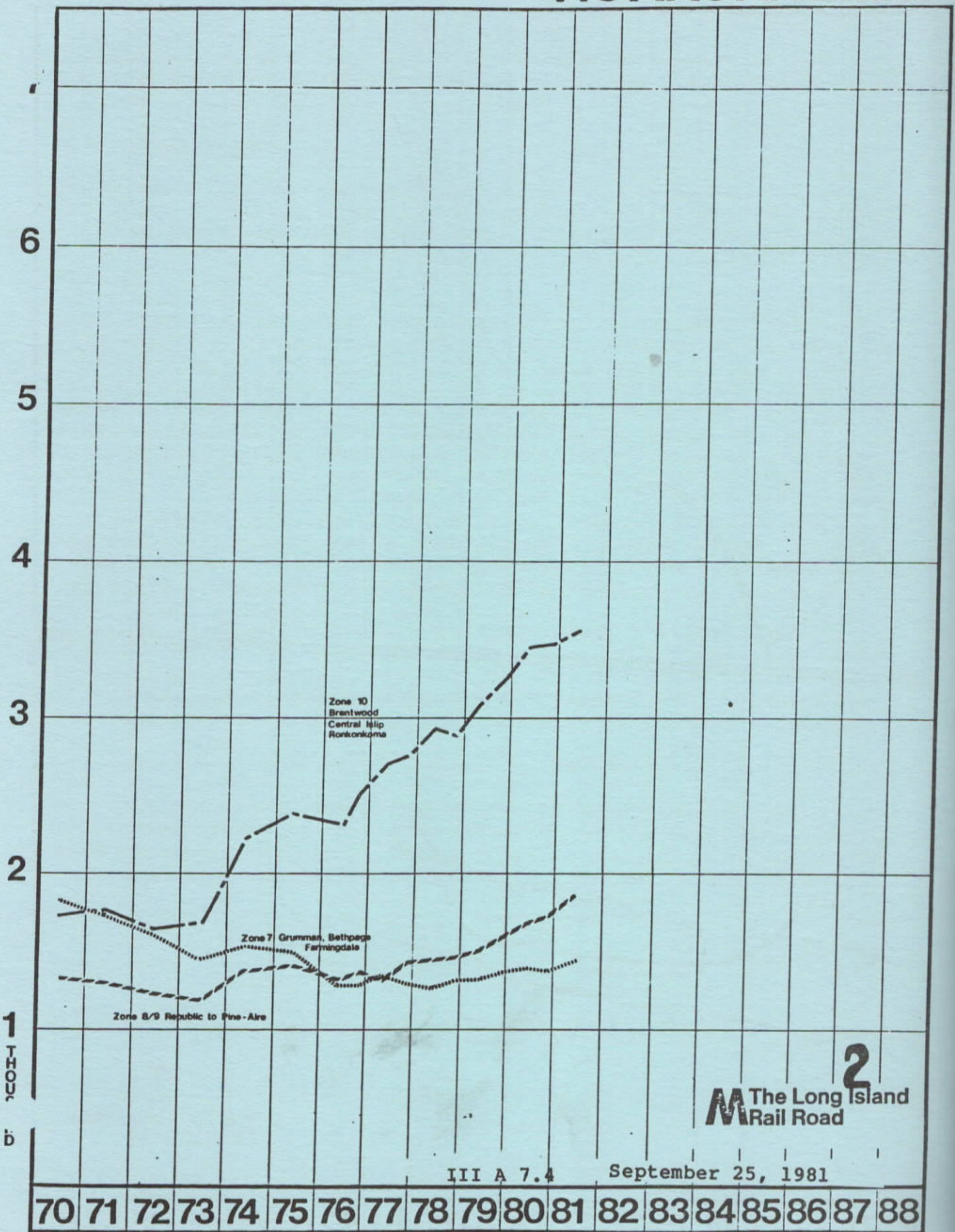
Daily Commuters

PORT JEFFERSON



 September 25, 1981 Aug 81 May 81

Daily Commuters RONKONKOMA



Issued: Aug 81
Effective: May 81

Electrification Extension of LIRR to Northport

The Port Jefferson Branch is one of the LIRR´s most heavily travelled lines. Extending electrification and installing reverse signalling for approximately five miles between Huntington and Northport will provide over 2,700 rush hour passengers with improved service as well as providing adequate diesel/electric transfer facilities at Northport. Exhibit A shows all passengers in diesel territory on the LIRR. As can be seen in this chart, almost half of the Port Jefferson Branch commuters will be within the electrified territory with only a 5 mile extension of electrification.

This project will further impact on the almost 4,000 passengers east of Northport who will benefit from the project. The frequency of off-peak service on the branch in both diesel and electric service will be increased. The present three sets of diesel equipment will be able to be better utilized and will allow the current 80 minute frequency of off-peak service to be (an easy to remember) 60 minute service. Electrification will enable the release of Port Jefferson Branch diesel cars to cover over rush hour diesel service.

In 1970, electrification was extended on the Port Jefferson Branch. Huntington was not intended to be a terminal point for electric service, but rather the first step in a staged electrification project that would eventually encompass the entire branch. The project now stays within the present right of way of property lines and will include sound and vision screens along the right of way at Northport Station.

In the eleven years since the electrification extension, Huntington has had to function at a less than optimal transfer point for diesel to electric service, with parking congestion and passenger inconvenience.

One decade later, the population of the area has grown and energy costs have caused ridership to increase significantly. The diesel/electric transfer at Huntington, both time consuming and inconvenient for the passenger, will instead occur at Northport with a modern across-the-platform facility. The new facility will solve the problem of end to end scoot connections for diesel/ electric transfers. It will eliminate the jammed narrow platforms and the six minute passenger delay required for transfers between diesel and electric equipment.

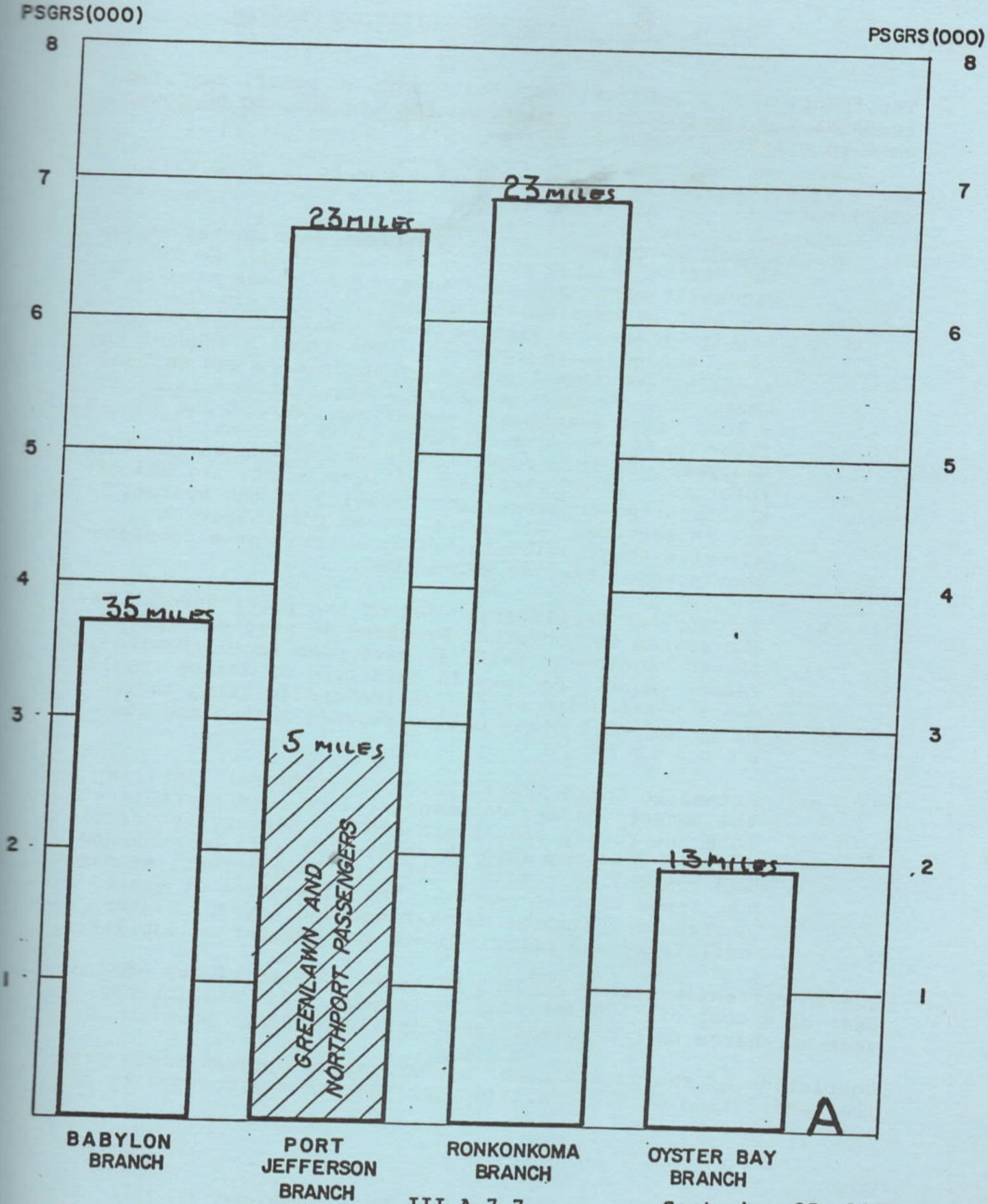
The benefits of the project for the riders of the Port Jefferson Brach are:

- replace poor existing passenger transfer facility at Huntington

- allows increased frequency of off-peak service, both diesel and electric

- provides additional through service to Penn Station
- parking congestion reduced and spread among other Town of Huntington stations
- release diesel cars for assignment to other diesel branches

LIRR PASSENGERS IN DIESEL TERRITORY



 September 25, 1981

NYCTA POWER SYSTEM MODERNIZATION PROGRAM

The function of a substation is to convert AC power, supplied by PASNY via the Con Edison distribution systems, to DC power used to operate the subway system.

Three types of devices are currently in use to perform this conversion:

a: Rotary Converters: These machines were installed on the IRT/BMT system between 1900 and 1920. No replacement parts are available. Many times repairs are made by cannibalizing other rotaries in the station thereby stripping these stations of reserve power needed in emergencies. The same is true of the ancillary equipment such as transformers and switch gear. The AC power supplied these stations is 25 hz - long since abandoned by everyone, except the TA, in favor of 60 hz. Con Edison′s 25 hz generating equipment is in a condition as precarious as the TA′s rotaries. 28 of these substations, supplying 30% of the total power conversion capacity of the system, are in service. Without a strong modernization effort a very real possibility exists for a complete shut down of the IRT/BMT system.

b: Mercury Arc Rectifiers: 75% of the power used on the IND system is converted by these 40 year old rectifiers. Equipment failures have been accellerating in recent years. Failure in this type of device usually means destruction of the device and faulting in the cable and duct lines making repairs costly and time consuming.

c: Automatic Solid State Silicon Rectifiers: This is the conversion device which will be used to replace both the rotary converters and the mercury arc rectifiers. Stations with these devices will be unmanned and controlled remotely from the 53rd Street, Manhattan Power Control Center. The advantages of these devices are simpler maintenance and repair, higher efficiency and reserve power and greater reliability.

The TA currently uses 2 billion KW hours of electricity per year at a cost of $100 million, including a $9.5 million per year surcharge to Con Edison for maintaining 25 hz power.

Completion of the entire power modernization program would mean the realization of $27.5 million per year in savings due to an

elimination of 425 positions in the manned substations, elimination of 25 hz surcharge, an average 3% increase in conversion efficiency and a decrease in annual maintenance and repairs.

At the outset of the 5 year program the Authority expects to construct 26 new substations and re-equip 10 others on the IRT/BMT system. On the IND system, 25 units will be re-equipped.

At the end of this program, 9 old substations will be closed and the Authority will be operating a new total of 214 substations, instead of 190. Remaining for conversion on the IRT/BMT system at this time will be (5) 25 hz, manually operated rotary stations; (2) 25 hz, mercury arc, automatic stations; and (11) 60 hz, mercury arc stations. On the IND system (53) units will remain to be re-equipped.

METRO NORTH POWER PROGRAM

The Metropolitan Region traction power system for the Harlem/Hudson Lines is composed of 19 DC substations and 209 miles of contact rail. Alternating current purchased from the utility company is changed to direct current at the substations for transmission to the contact rail where it is picked up by the rail cars. This system is crucial to the operation of the Region's 483 daily electric trains. Without this system the service on the Region would literally come to a halt.

The DC traction power system was constructed in segments between 1907 and 1911 and was one of the premier railroad electrifications in the country. The majority of the substations utilize large rotary converters to change the AC power to DC for use by the cars. A small number of substations use mercury-arc rectifiers to convert this power. All of the substations are obsolete and prone to breakdown. Some of the manufacturers of the equipment have been out of business for many years and parts are unobtainable. New parts often must be custom made. In addition, all of these substations must be manned continuously by one or more qualified operators.

The contact rail which transmits the power from the substations to the cars is 70 lb./yard and has not been manufactured since 1950. The rail has deteriorated from service demands and exposure to the elements. The resulting severely reduced conductivity of the rail results in decreased train performance and problems with railcar systems. These problems, affecting air conditioning, motors and propulsion controls, are similar to that experienced by household appliances during a "brownout," only on a larger scale. Train performance, hampered because the low conductivity of the rail cannot deliver sufficient power to the cars, is further reduced by failure of substations. These failures produce areas in the system where there is so little power that operating trains lose up to 40 MPH in speed and run at reduced speed for long sections housed in approximately 30 new substations.

The Capital Program entails replacement of all substation equipment with modern reliable solid state equipment housed in approximately 30 new substations. In addition, control of these substations would be performed at central control point making possible more efficient utilization of personnel. In addition, the deteriorated contact rail will be replaced with standard 150 lb./yard rail.

Passengers will benefit from this program in the form of more reliable, and more comfortable service. In addition, operating savings of over $1 Million annually will accrue from the increased utilization of personnel. If the replacement of obsolete components is not undertaken, however,

service reliability and on-time performance will deteriorate. Failure of the traction system will precipitate delays of increasing duration and magnitude.

In addition to the DC power system on the Harlem/Hudson lines, the New Haven line traction power system is also in a precarious position. Failure of either the outmoded Cos Cob Power Plant or West Farms Substation seriously threaten the cessation of service on this Line. Because the proposed conversion of this system from 25 HZ to 60 HZ has been delayed for 3-4 years, it becomes imperative that the existing system remain operational for this period. The capital plan provides funding for emergency repairs to this system until the 60 HZ conversion is completed.

The New Haven catenary, the network of over-track wires which transmits traction power from the generating plant to the rail car, is another critical aspect of the service. The portion between Woodlawn, N.Y. and Stamford, Ct. was built in 1907 with steel cables supporting the actual contact wires which are bronze. These cables, the geometry of which is obsolete, have deteriorated and require replacement. Funding has been provided in the Capital Program to undertake an engineering study of the catenary to determine the feasibility and costs associated with the options of replacing this system. These options might include replacement in kind (replacement of deteriorated steel cables with bronze) or upgrading to a more up-to-date system such as constant tension. The constant tension system compensates for the expansion and contraction of the wires caused by fluctuations in temperature. The resulting sagging and over-tensioning of the wires causes wire failures and pulldowns which precipitate service disruptions and delays often on a massive scale. The advantages of a constant tension system are reduced maintenance, fewer failures and improved train performance. The study will determine the feasibility and cost effectiveness of this replacement.

METRO-NORTH SIGNAL IMPROVEMENT PROGRAM

The Harlem and Hudson Signal Improvement Program consists of the complete modernization of the existing signal system on the Hudson and Harlem Line of Conrail between Mott Haven Junction in the Bronx and Brewster on the Harlem Line and Croton-Harmon on the Hudson Line. The new signal system will provide for cab signalling, overspeed control, reverse signalling on all tracks and centralized control of all interlockings.

On a typical railway signal installation, the signal system provides information on the occupancy of the track governed by the signal. Cab signals provide this indication inside the train operators compartment. This permits uninterrupted information as to the appearance of the signal which is not affected by adverse visibility conditions such as snow, fog, etc. Cab signals also provide continual information on the signal appearance thus continually reminding the operator as to the condition of the track in front of the train. Each signal indication has a maximum operating speed associated with it. Overspeed control provides a means of enforcing the maximum speeds associated with each signal indication. In the event that the engineer is exceeding a speed associated with the signal indication, a warning is sounded and the operator is given a limited amount of time in which to acknowledge the warning and reduce speed accordingly. If this is not done, the train brakes are applied automatically.

Reverse signalling permits train operation in either direction on a track. In areas of multiple tracks, such capability permits an increase in the capacity of the tracks (as an example in 4 track territory, 3 tracks can be utilized for trains travelling in the direction of predominant travel) and also permits rerouting of trains around delayed trains, maintenance work, etc. Centralized control of interlockings permits a train dispatcher to control a series of interlockings from a central location. Such control tends to improve service by providing the dispatcher with real time status of all trains and interlockings under his control. At present, remote individual towers are controlled by each tower operator under orders from the dispatcher. Central control will permit a dispatcher to set up train routes through several interlockings at once, as well as permitting indentification of potential disruptions of service, permitting the dispatcher to reroute trains before major service interruptions can develop. Man power efficiencies will also be realized.

In addition to the above major elements of the signal program, communication facilities will be improved and new sources of

signal power will provide together with their associated transmission lines. Carborne cab signal apparatus for use with the new signal system will also be purchased and installed.

The individual elements of this program are as follows:

1. <u>Mott Haven Junction to Croton-Harmon</u>

   In conjunction with the three tracking program cab signalling with overspeed control, together with reverse signalling, will be provided on all three tracks. Existing interlockings will be modernized and converted to centralized control. A portion of this project has been funded from a pre-1982 grant.

2. <u>Mott Haven Junction to Mt. Vernon West</u>

   Cab signalling with overspeed control, together with reverse signalling, will be provided on all four existing tracks. The existing interlockings will be modernized and converted to centralized control. Work on the segment between Mott Haven Junction and Woodlawn is underway and is funded under a pre-1982 grant.

3. <u>Mt. Vernon West and North White Plains</u>

   The existing signal system on this section will be modernized. Cab signalling and overspeed control will be provided. The existing reverse signalling system will be upgraded with new components and the existing centrally controlled interlockings will be upgraded utilizing state of the art components. The existing interlocking at North White Plains will be converted to centralized control.

4. <u>North White Plains to Brewster</u>

   A new signal system compatible with the electrification will be provided. Both tracks will receive cab signalling with overspeed control, and will be reverse signalled. Two new interlockings with central control will be provided and the existing interlocking at Brewster will be modernized and converted to centralized control. A portion of this project is funded with pre-1982 funds.

SECTION III B2

FUNDING PLANS

INTRODUCTION TO FINANCING

Under the terms of the Transportation Systems Assistance and Financing Act of 1981, the plan being provided to the Capital Program Review Board includes "an estimate of the amount of capital funding required each year and the expected sources of such funding." (See Section II.) However, there are a number of issues relating to this funding plan for which supplementary information is being provided.

Like the capital program itself, the financing of the MTA program is a major undertaking and will be a dynamic process throughout the five year period. Funding will be derived from a number of different sources, each with unique constraints and opportunities. These funds will be applied to a variety of projects with differing schedules of accomplishment and financing. Most of the funding is based on state and federal legislation which were enacted quite recently, and for which there is no established set of precedents. Most significantly, about 60% of all the expected funding is to be raised in the form of long-term bonds and leases, thus subjecting the program to the financial discipline and constraints of competitive capital markets at a time when these markets are suffering unprecedented problems and uncertainties.

Given these broad concerns and some specific matters that will be explored in the course of this section, it will be necessary to maintain a great deal of flexibility in the approach to financing the capital program. What is reflected in the plan and explained at greater length in this supplementary chapter is the approach which appears most advantageous on the basis of present conditions and is the approach we intend to follow. However, as conditions change it may be necessary to modify our financing approaches to meet those conditions, and program plan includes the flexibility to make such a response.

In particular, it has been suggested by some members of the Capital Program Review Board that the capital plan should identify the specific sources of funding for particular projects. While this is not a requirement of the Transportation Systems Assistance and Financing Act of 1981, it is understandable in light of recognized uncertainties about financing. Proponents of individual projects naturally seek to have the most certain sources of financing associated to that project. But for precisely the same reason that the amount and timing of funding availability cannot be projected with precision, it is neither reasonable nor prudent that MTA should limit its flexibility with respect to the use of individual funding sources for individual projects over the duration of the five-year program. Rather, it will be our goal to

array and use financial resources in a way that maximizes the availability of total funding at the minimum practicable financing cost for the total program.

SUMMARY OF FINANCING NEEDS AND SOURCES

Over the period covered by this plan, MTA will have to raise a total of $7.9 billion to accomplish its capital program. This total includes two matters not identified in the five-year capital program which are directly linked to the financing of the program. First, there are certain projects now underway with financing to be derived from Triborough Bridge and Tunnel Authority (TBTA) bonds. Since the newly-authorized TBTA bonding authority extends the existing authority, and since the bulk of these bonds have not yet been sold, this financing plan and strategy includes $198 million for such projects.

Second, it will be necessary to establish debt service reserve funds in connection with each of the bond issues contributing to the capital program financing. These funds are created through the sale of bonds in addition to those needed for capital construction, using the proceeds to establish a reserve equal to the maximum debt service needs in any future year. At our current estimates regarding interest rates and debt structure, a total of $559 million must be raised in order to create the necessary reserve funds.

Taking these two financing needs in addition to the $7.3 billion in capital projects identified in the five-year plans for the Transit Authority and commuter railroads, there is a total financing need for $7.935 billion between now and 1986-87 to carry out the MTA capital program. The major types of work to be financed and the expected sources of funding are summarized in Table I below.

Table I
MTA CAPITAL PROGRAM
Sources and Uses of Funds
($ in millions)

Sources		Uses	
Commuter Rail Program			
Federal	169	Leased Cars	501
State	144	Other 5-Year Plan	866
TBTA Bonds	440	1979 TBTA Bond Projects	100
ASC Bonds	214		1,467
Revenue Bonds	400		
Lessor Equity	100		
	1,467		
TA/SIRTOA Program			
Federal	1,933	Leased Cars	1,749
State	197	Leased Buses	312
City	565	Other 5-Year Plan (RT)	3,358
Port Authority	88	Other 5-Year Plan (Bus)	367
Other	90	Other 5-Year Plan (SIRTOA)	25
TBTA Bonds	660	1979 TBTA Bond Projects	98
ASC Bonds	396		5,909
Revenue Bonds	1,600		
Lessor Equity	380		
	5,909		
Debt Service Reserve Funds			
Bonds	559	Funds Established	559
GRAND TOTAL	7,935		7,935

NOTE: Financing total of $7.935 billion includes $7.178 billion for projects to be committed as part of the five year capital plan, plus $198 million in TBTA bonds to cover projects begun under the 1979 bond program, plus $559 million in bonds to fund necessary debt service reserves.

Based on the specific strategies and rationales developed further in this chapter, it is our current plan to use the funding sources available to us in the manner outlined in the table below:

Table II
PROPOSED USES FOR INDIVIDUAL FUNDING SOURCES
($ in millions)

Source	Funds Available TA/SIRTOA	Funds Available Commuter	Proposed Use
Federal	$1,933	$ 169	General construction and procurement of fixed facilities and equipment other than rolling stock.
State	197	144	Funds available from past bond issues or derived from reprogrammings used to match federal aid.
City	565	-	Regular city capital budget funds used for independent projects in system rehabilitation.
Other	90	-	Litigation proceeds and other non-grant funds used to match federal aid or finance other non-rolling stock projects.
Port Authority	88	-	Procurement of buses, in conjunction with equity contribution through leveraged leases.
TBTA Bonds	660	440	Bond proceeds to match federal aid or finance other non-rolling stock projects, including those authorized in the 1979 legislation.

Table II (continued)
PROPOSED USES FOR INDIVIDUAL FUNDING SOURCES
($ in millions)

Source	Funds Available TA/SIRTOA	Funds Available Commuter	Proposed Use
Annual Service Contract Bonds	396	214	Bond proceeds to match federal aid or finance other non-rolling stock projects.
Revenue Bonds	1,600	400	Bond proceeds used to finance cars and buses, with equity contribution through leveraged leases.
Lessor Equity	380	100	Equity contributions provided by equipment lessors in conjunction with MTA debt to finance cars and buses.
Debt Service Reserve	400	159	Bond proceeds deposited in mandatory accounts to provide security to bondholders.
TOTAL	$6,309	$1,626	

RISKS AND UNCERTAINTIES

Given the nature of the financing sources involved in this plan, precise adherence to the precise funding strategy described below is not possible. However, in developing the strategy, we believe that reasonable assumptions were followed and that the plan reflects average conditions that can reasonably be expected to prevail throughout the next five years. The size of the capital program has been tailored to this assumed funding level, with some flexibility to add or subtract projects as the process unfolds.

Nevertheless, there are risks and uncertainties that should be noted, and these are spelled out below. Taking all of these variables into consideration, it is possible to bound the adopted funding strategy with "worst-case" and "best-case" scenarios. If, for example, everything were to go wrong, one can visualize a situation in which bond market conditions totally preclude borrowing at any acceptable interest rate. Under those circumstances, a bare-bones capital program consisting of only the $3.0 billion in appropriated sources, or less if further Federal budget cuts occur as well, will have to be developed. At the other extreme, it is possible to conveive of circumstances in which FederaL, City and State appropriations are expanded and interest rates permit additional borrowing with the available debt service resources. Under those conditions, a capital program of some $9 to 10 billion would be practicable. Given the surveys of economic conditions and public policies over the next five years, one strategy shall be designed to meet changing conditions rather than predict the conditions that might prevail and lock into them.

In order to develop a capability to respond to changing conditions, we need to understand and evaluate the major risks.

The variety of factors - many of them as yet unresolved - which will come to play in decisions relating to funding allocation, and their interaction makes for an almost infinite variety of possible contexts in which MTA will ultimately make allocation decisions.

The following section sets forth in summary form some specific constraints and uncertainties regarding the various funding sources:

<u>Private Funds - Rolling Stock Financing Strategy</u> - The formulation of the capital program was originally premised on the assumption that Federal Section 3 funds would be used to the maximum extent possible to fund planned subway and commuter car procurements. Underlying this strategy was the goal of reducing

MTA's involvement in federal grant procedures, and the host of regulatory constraints which accompany those procedures. By targetting available federal aid to a limited number of high-priced rolling stock contracts, the balance of the program - consisting mainly of relatively low and moderate price construction contracts - could take advantage of the more flexible contracting procedures authorized by State law.

With the passage of the 1981 tax legislation, which included provisions facilitating leveraged leasing of transit equipment, MTA entirely revamped its capital program to take advantage of the potential availability of private investor capital for rolling stock acquisitions. Because the tax legislation appears to provide tax benefits to lessors only when private capital is combined with local bond funds, and leasing is largely restricted to vehicle acquisition, it is now appropriate for MTA to use its local bond proceeds for rolling stock.

While this recent switch in overall funding strategy is offered to illustrate the necessity of maintaining flexibility to respond to a changing legal and fiscal environment, it also means that a substantial portion of the financing plan is now dependent on successful negotiation of largely unchartered waters in the private leasing market.

MTA's financing plan now assumes a 20% private equity contribution for rail cars and a 10% contribution for buses. These estimates, which are considered conservative, may still fluctuate dramatically in either direction on the basis of a number of factors include: (1) the ability of the lessor market to absorb the increased availability of equipment eligible for lease financing; (2) leasing regulations to be promulgated by the I.R.S.; (3) changes in Financial Accounting Standards Board (FASB) accounting rules to take account of the new leasing provisions; (4) Congressional passage of a technical amendment relating to "at risk" provisions applicable to privately held corporations; and (5) potential later availability of the investment tax credit as a further inducement to leasing.

<u>Federal Funds</u> - With respect to federal capital assistance, which is now tentatively earmarked for a variety of civil construction and procurement projects, there is no certainty as to timing or amount. The new Administration has repeatedly expressed its support for the rail and bus modernization component of the Section 3 Capital Assistance Program, so one could reasonably expect that MTA's share of the federal program would be maintained at least at its historical level. However, there is no certainty that the Administration will be successful in maintaining its position with respect to "new starts" in the face of both previous commitments and Congressional support for such projects. Should there be an allocation to new start projects without an overall

program increase, the shortfall in modernization funds is likely to come at MTA's expense.

Moreover, the Administration is considering two legislative initiatives which could further affect the availability of federal capital assistance. First, the total elimination of the Federal Aid Urban System (FAUS) program has been proposed. The five-year plan assumes receipt of $20 million a year from this program. Even if the program survives, there are competing highway needs within a firm ceiling on highway expenditures. For example, it has been suggested that FAUS funds now used for transit be allocated to finance an allocated share of the rehabilitation costs of New York City bridges shared by transit lines, on the reason that highway bridge funds cannot be applied to this element of bridge rehabilitation.

In addition, a proposal is in the process of internal Administration review which would restructure federal transit assistance in a block grant program. Some portion of this grant would likely be available for operating assistance, and it is not at all clear whether the decision to use the totality of federal assistance for capital purposes would be left to MTA's discretion. Again, if the federal program is not expanded, diversion of funds to operating assistance would reduce the availability of federal capital grants.

Changes in the regulatory environment which accompany federal grants will also impact on MTA's decisions as to the use of federal funds. As mentioned previously, federal assistance is restricted by a host of regulatory constraints which require federal sign-offs at a number of checkpoints in project implementation. It would be to MTA's advantage in a number of shop and depot moderanization projects for a single contract to be let which would include scope, design, and construction. As current federal procedures do not permit this procedure, such a contract would be let using local funds. However, MTA is also currently in the process of seeking changes in those federal regulations which restrict contracting procedures, and it would be its intention to use federal funds for projects of this nature should this effort be successful.

Finally, with respect to federal funds, it is essential that MTA maintain a bank of locally funded projects or available cash sufficient in dollar amount to provide the required 20% local match. While the absolute dollar amount presents no substantial problem, it is important to note that under existing law locally funded projects must be "federally qualified", that is, they must conform with all federal procedural requirements. At this point in time, it is impossible to determine the dollar quantity of local projects for which MTA could derive savings by contracting in a manner inconsistent with federal procedures. Assuming the amount to be substantial, it may be necessary to use MTA revenue

bonds for these projects, because revenue bonds are under present law generally unavailable for use as local match. (Alternatively, MTA may be successful in its effort to amend federal law on this issue.)

<u>State Funds</u> - The plan assumes the use of $90 million in 1967 Bond Issue proceeds which had previously been appropriated for the Transit Authiority, but had been reserved for matching Federal projects. It has been suggested recently by the State Budget Director that, over a period of several years, the proceeds of the 1967 Bond Issue were overappropriated and that the residual funds assumed in this plan by the Transit Authority will not be available. This issue is still under discussion with the state.

<u>Local Bond Funds</u> - Over 60% of the total five-year program is to be raised in the competitive financial marketplace. Of the three forms of bonds that are expected to be issued only one, that of the Triborough Bridge & Tunnel Authority, has a firm track record. Recognizing the present state of the public bond market, and the numerous uncertainties which attach to the sale of any new offering in this environment, it is unrealistic for MTA to spell out a rigid approach which it expects to follow over a five-year period.

The prospect for sale of any form of MTA security at any time in the near future must realistically be viewed as problematic at best. This uncertainty is not only a function of interest rate, but also the capacity of the market to absorb substantial amounts of new public paper. This is a problem not only for MTA but for all public agencies, and we will benefit to the extent national attention is provided towards solutions for this general problem of state and local government. It should also be recognized that the market may react differently at any given point in time to each of the three forms of MTA-related securities which have been authorized by the State Legislature.

As described above, MTA has several marketing options which are now being actively explored and which will ultimately be combined into a mixed strategy. Our options include: (1) regular public sale of the three forms of securities; (2) private placement of one or more issues; (3) private placement coupled with equity placement of leveraged lease capital; and (4) private placement in conjunction with a manufacturing contract. With respect to the timing of sales under any of these options, MTA could market debt at the time of contract commitment or, alternatively, at the time payment becomes due.

MTA is not yet in a position to define the most advantageous course. Obviously, this depends on changing market conditions and a process of negotiation which is only now beginning.

NEED FOR FLEXIBILITY

To define precisely at the present time which form of MTA security should be offered to fund a particular project would be an exercise without meaning. MTA must maintain the flexibility to sell bonds as needs and opportunities arise in the form and amount that are best suited to market conditions at the time of issuance. To identify projects with specific sources of funds at this time would deny MTA the opportunity to use its best business judgment in responding to changing circumstances.

Finally, MTA seeks the flexibility to seek legislation, should the need arise, to revise its capital borrowing authorization to permit the issuance of debt at the most favorable rate. Assuming, for the moment, that early experience suggests a more favorable market for service contract and TBTA issues, MTA may wish to sell bonds only in these two forms. So as to maintain the level of the planned program, this would require legislative authorization increasing TBTA debt limitation and converting at least a portion of the State's current annual appropriation for operating assistance to a long-term contractual basis so that it can be used to meet debt service. Alternatively, legislation may be needed to dedicate certain of the recently enacted State taxes for debt service purposes to give greater security to the revenue bonds.

DESCRIPTION OF SPECIFIC FUNDING SOURCES

There are nine specific funding sources identified within the financing plan, each with its own set of rules and its own assumed schedule of availability. The description below covers the features of each funding source as it is intended to be used in the MTA financing plan. The MTA plan has been developed on a calendar year basis, with funds from agencies operating on different fiscal years folded in as appropriate to the situation.

Federal Assistance - The plan assumes the continued availability of federal capital grants through the Urban Mass Transportation Administration. The amounts shown are based on an analysis of the announced budget plans of the current federal administration, assuming retention of the current funding categories and continued receipt by the MTA of its historical share within those categories. We will, of course, seek larger allocations in line with our needs and our share of national transit activity. On these assumptions, the following amounts of federal assistance would be available:

- Section 3 discretionary funds will remain at their 1981 level of $273 million through 1983 and then increase at 10% a year. This assumes that federal support of rail modernization and bus programs at the national level will be sustained or increased while support for new start projects is phased out. The current split between TA and commuter rail projects is assumed to continue.

- Section 5 capital funds will increase at 10% a year from their current level of $35 million.

- FAUS funds for transit projects will remain at the current level of $20 million per year.

- The balance of transit funds derived from the Long Island Expressway trade-in will be drawn down in 1982.

- No significant new Urban Initiative Grants will be received.

Under these assumptions, a total of $1.933 billion in federal capital assistance will be available for Transit Authority projects and $169 million for commuter rail projects. Additional Federal funds will be made available to the suburban New York counties for bus projects and to the State of Connecticut for NHRR projects outside the scope of this plan. Since, as discussed below, all rolling stock financing is assumed to be done with non-federal *funds, it will be necessary to use federal capital grants on a wide variety of construction and system modernization work.* Further analysis and possible modification to the timing of the work program will be necessary to match the work plans to the availability of federal funds by specific fiscal years and purposes.

<u>Existing State Funds</u> - Under the terms of the Transportation Systems Assistance and Financing Act of 1981, funds heretofore appropriated to the State Department of Transportation for MTA projects were transferred to the control of the MTA. Thus, certain unspent state bond issue authorizations and other state funds have been included in the funding sources for the program. Discussions are now underway with the State as to the exact balance of funds available, with the possibility existing that current estimates will have to be reduced. In addition, certain rolling stock now on order and currently funded with state money has been incorporated into the program, along with the funds reserved for that purpose. The plan contemplates refinancing of that rolling stock, thus freeing up these state funds for other purposes.

A total of $341 million in existing State sources is assumed to be available for use in financing the program, with $197 million allocated to the Transit Authority and $144 million to the commuter railroads.

City of New York Funds - The program plan assumes the availability to the Transit Authority of City capital funds in the amounts carried in the City's current capital budget, i.e., $165 million during 1982 (City FY82 funds) and $100 million a year thereafter for a total contribution of $565 million to the five-year program. It is assumed that these funds will be applied to discrete projects, to be funded on a 100% City funds basis. These projects will be similar to work previously undertaken with City capital funds, including car rehabilitation or enhancement and other capital rehabilitation work on the system. As described in the plan, car overhaul work, as distinct from major rehabilitation, will be financed through the Transit Authority's operating budget.

Port Authority Funds - The Transportation Systems Assistance and Financing Act of 1981 authorizes the Port Authority of New York and New Jersey to provide up to $200 million in new capital funds for bus projects in the two states. The statute makes an allocation of $88 million in such funds to Transit Authority projects, and it is assumed that these funds - in conjunction with other funding sources - will be used for the purchase of buses. It is further assumed that the funds will be available in three equal installments during the years 1982-84. New Jersey will have to enact similar legislation before these funds can be committed.

Other Funds - It is possible that from time to time other funds will become available from sources not specifically identified in the plan. Such funds will be applied to the program as appropriate. The only currently identified source of other funds is a potential recovery of $90 million in connection with the Transit Authority's litigation over the R-46 cars. These funds are assumed to be available for general use in the TA program during 1982.

Bond Funds - The Transportation Systems Assistance and Financing Act of 1981 created three new potential sources of bond funds for the MTA capital program, subject to certain financial and legal constraints. The specific nature of each bond source is highlighted below, while the strategy for their use in a way that best suits the overall purposes of the plan will be discussed subsequently. Generally, the three types of bonds must be considered to be as interchangeable as possible within the legislative intent that preference be given to those bonds with lesser direct impact on the operating budgets.

Triborough Bridge and Tunnel Authority (TBTA) Bonds - The 1981 Act expands the limitation on TBTA bonds for public transportation purposes from the current cap of $300 million to a total of $1.1 billion. Certain projects begun under the $300 million authorized in 1979 are to be continued, thus making their financing an integral part of financing the new 5-year program, as discussed above. The new limitation is further allocated between agencies, with the Transit Authority limited to $660 million and the commuter railroads to $440 million. Bonds issued for a debt service reserve are not included in the limit. There is provision for a chargeback of the debt service on these bonds against the TBTA surpluses that would otherwise flow to the TA and MTA as an offset to operating deficits.

Annual Service Contract Bonds (ASC) - The Act authorizes the Director of the State Division of the Budget to enter into contracts for the continued capital support of the Transit Authority and the commuter railroads. Funds for this support, which are to be provided through annual appropriations, are limited to $52 million for TA projects and $28 million for commuter rail. The MTA is authorized to issue revenue bonds and pledge the service contract proceeds as security for those bonds. Thus, the amount of capital financing that can be done with these bonds is dependent on the amount of debt that can be serviced with the annual amount at current interest rates. Using the current cost of TBTA debt (12.75%) as a benchmark (and assuming no net cost for debt service on the reserve fund bonds), the limit on ASC bonds is $610 million, with an allocation of $396 million to Transit Authority projects and $214 million to commuter railroads.

Revenue Bonds - In addition to the bonds noted above, the MTA is authorized to issue its own general obligation and special obligation bonds, to be retired from operating income. These bonds have been popularly referred to as "farebox" bonds, but in fact would be secured by all authority revenues, including both fares and various subsidies to the extent they can be used for debt service. The Act provides a specific $1.6 billion limit on the amount of revenue bonds to be issued by MTA for Transit Authority purposes, creating a mechanism whereby TA revenues are pledged to the MTA in support of these bonds. For the purposes of the financial plan, it has been assumed that $400 million MTA revenue bonds would be issued to finance projects for the commuter railroads.

Leveraged Leasing - The final source for financing the program is funding derived from equipment leases made possible under the recently passed Economic Recovery Tax Act of 1981. This piece of federal legislation makes it possible to structure leases in a way that the tax benefits of equipment ownership (e.g., capital cost recovery, interest payments, etc.) can be separated out from other aspects of ownership and transferred to another

party. This provision was designed to benefit industries with large capital needs but without net income sufficient to make the normal tax write-offs possible. The transferrable write-offs which these unprofitable companies generate through capital investment have considerable value to other, more profitable, entities, who will be willing to enter into leases in order to shelter their profits. The provisions of the tax bill were broad enough to encompass the situation of governmental transportation agencies, such as MTA, which have no profits, but are making a substantial investment in equipment that could be an attractive tax shelter for profitable corporations.

The exact nature of the leases to be entered into is still being established, and will have to be tailored to fit the type of equipment to be leased; the status of the lessor and the nature of the income to be sheltered; and the ultimate tax and accounting regulations promulgated to fit these leases. However, initial discussions with financial institutions have established that there is a potential market for MTA equipment leases. For the purposes of the financial plan, it has been assumed that all MTA rolling stock now on order or expected to be ordered during the five-year plan will be placed under lease in order to gain the advantages of the tax benefit transfer. The exact amount of additional financing to be generated through this device will depend on market factors. However, for planning purposes we estimate that rail rolling stock can be financed on the basis of 80% MTA funding plus 20% from a lessor and that the price of buses can similarly be divided on a 90%/10% basis. It is further assumed, subject to discussions with the federal government, that the MTA share of the transaction must be financed with some source other than federal money. On the basis of these assumptions, we calculate that $480 million in lessor equity can be raised to support equipment purchases, allocated $380 million for Transit Authority rail cars and buses, and $100 million for commuter rail cars. The timing of these transactions is discussed below. Some timing issues may arise because of the 1984 statutory termination date for issuance of tax-free industrial development bonds in connection with these transactions.

FINANCING STRATEGY

Given the complexity of financing sources and projects to be financed, it is important to approach the problem with a coordinated strategy if the overall financing goal of maximum funding at minimum cost are to be met. At this point, based on the relative availability and constraints of the various financing sources, it seems most appropriate to approach the issue of financing the rolling stock separately from the balance of the

program. The balance of the financing strategy discussion is separated in these two broad categories.

Rolling Stock Financing - The overall capital program will require $7.4 billion in financing, exclusive of debt service reserves. Of this total, approximately $2.6 billion, or 35%, represents the cost of the new buses and rail cars to be purchased. There are five major categories of rolling stock within the plan, as shown in Table III below:

TABLE III
MTA ROLLING STOCK PROGRAM
($ in millions)

	Quantity	Years of Delivery	Price Including Escalation
IRT Subway Cars	1,150	1983-86	$1,377
IND/BMT Subway Cars	226	1986-87	372
Commuter Cars & SPV's	140	1981-83	156
Commuter Cars	272	1983-85	345
TA Buses	1,600±	1982-86	312

With the exception of the buses, for which there is a large national market and for which annual bidding is practicable, the balance of the rolling stock procurement represents very large orders of a product for which there are few suppliers and even fewer buyers. The procurement strategy must be tailored to this situation, and should be backed up with financing that will ensure that the MTA obtains full advantage of its stature as the prime national buyer in this market.

Actual payments on the rail equipment can be spread over a period of years, reflecting the contract terms. These terms generally involve some advanced funding at the front end with the balance coming in the form of progress payments and delivery payments over a period of years. While it would be most comfortable to have all the funds for a car order in hand before it was placed, the size of the orders and the long lead times involved argue against such an approach.

In terms of funding sources, it had been the MTA's plan to use federal funds for the primary source of rolling stock financing. However, the attractiveness of the leveraged leasing arrangements make it more appropriate to use that form of financing, and it does not now appear that federal grant funds can be used to generate tax advantages. Thus, the leasing funds must be matched with one of the other sources of MTA financing.

Taking all of these factors into consideration, the most appropriate strategy for major rolling stock financing appears to be a combination of leasing with revenue bonds, negotiated in a way that tailors the terms and availability of the financing (which will be influenced by the types of lenders and lessors interested in tax-free income) with the schedule of needs for financing the equipment. Our strategy would be to seek advance commitments for the full sum required to place an order, but with the drawdown of funds from the lessors and the bond purchasers to come over the total delivery period. Such a long-term commitment may require a high interest rate or a commitment fee in order to secure advance funding under conditions of market uncertainty. Alternatively, the MTA or the car-builder could arrange temporary financing during construction to permit optimum timing of the permanent financing. In either case, the assurance of funding and the concomitant ability to place large orders, would be reflected in substantial savings on the price of the cars through economies of scale.

Table IV, below, lays out the specifics of the rolling stock financing program. It assumes, for the purposes of the analysis, that five separate packages are to be financed or refinanced, consisting of the five categories of equipment shown in Table III. In fact, some of the smaller packages might ultimately be handled through our regular borrowing program. The year-by-year totals for each category of equipment indicate the rate at which the funding for both the lease funds and the revenue bonds commitments would have to be drawn down in order to meet scheduled payments based on current delivery estimates. In addition, the bond drawdown includes the amount of bonds necessary to establish the bond service reserves.

Table IV indicates a need to raise \$480 million in lessor equity and \$2,293 million in bonds (including debt service reserves) in order to finance the rolling stock program. However, because of the extended delivery schedules, the amounts in any given year are within a more manageable range. The total funding need in maximum years is in the range of \$600 to \$625 million. (It should be noted that the \$779 million figure shown for 1986 includes some funds not necessary until 1987.) This schedule will have to be confirmed once the delivery dates for rolling stock are established. The structure of the debt drawdown also satisfies the legislative concern that the bulk of the revenue bonds not be issued until the latter stages of the five-year program. Virtually all of the authorized revenue bonds (both TA and MTA) will be used in this fashion.

TABLE IV
ROLLING STOCK FINANCING PROGRAM
($ in millions)

Item	1982	1983	1984	1985	1986-87	TOTAL
IRT CARS ($1,377M)						
Lessor Equity	25	47	55	68	81	276
Debt including Reserve	113	218	251	315	370	1,267
Total	138	265	306	383	451	1,543
IND/BMT CARS ($372M)						
Lessor Equity	-	-	-	30	44	74
Debt including Reserve	-	-	-	137	206	343
Total	-	-	-	167	250	417
COMMUTER CARS ON ORDER ($156M)						
Lessor Equity	20	11	-	-	-	31
Debt including Reserve	91	53	-	-	-	144
Total	111	64	-	-	-	175
COMMUTER CARS TO BE ORDERED ($345M)						
Lessor Equity	11	37	21	-	-	69
Debt including Reserve	53	170	94	-	-	317
Total	64	207	115	-	-	386
BUSES ($312M)						
Lessor Equity	5	6	6	6	7	30
Debt including Reserve	23	28	32	69	71	223
Total	28	34	38	75	78	253
TOTAL PROGRAM ($2,562M)						
Lessor Equity	61	101	82	104	132	480
Debt including Reserve	280	469	377	521	647	2,294
Total	341	570	459	625	779	2,774

Assumptions:

- Lessor equity equal to 10% on buses, 20% on rail cars;
- Balance of funding through TA or MTA Revenue Bonds;
- Full financing committed in advance of order;
- Delivery schedule as specified in 5-Year Plan;
- Debt Service Reserve Bond issued in proportion to bonds required to finance program;
- Port Authority bus funds of $88 million have been deducted.

Considerable financial expertise will be necessary to match up these needs with the availability of capital in the marketplace, considering the wide variety of motives and factors affecting the financial markets. However, we have been advised that such placement of much or all of the rolling stock financing may be feasible and are proceeding to test this market.

Financing of Projects Other Than Rolling Stock - The balance of the program for the Transit Authority and the commuter railroads will consist of a multitude of large and small construction and procurement contracts, to be financed out of a mix of federal, state, local and bond funds. The total financing need in this area is approximately $4.8 billion, including the TBTA projects being financed concurrent with the five-year plan, but not the debt service reserve funds.

Of the total $4.8 billion, approximately $2.1 billion will be provided by federal assistance and $565 million from the annual City capital budget. Thus, the pace of this portion of the total program will be driven by the annual availability of funds from these appropriated sources and the necessity to provide funds from other sources to meet federal matching requirements.

As noted previously, there may be some problems matching the federal funding to project requirements on a year-by-year basis, particularly in the case of federal funds earmarked for bus purposes. It may be necessary to seek a multi-year, multi-purpose agreement with USDOT in order to make full use of the funds scheduled in this plan. Alternatively, statutory changes to the federal mass transit program now under consideration may provide the necessary flexibility.

Given this set of circumstances, it is our strategy to raise the balance of funds necessary to carry out this phase of the program through the conventional route of public bond sales. This will enable us to satisfy the federal requirements that all local funds be assured before federal funds are provided, as well as assuring maximum bidder interest in our contracts based on the knowledge that funding is secure. To the extent that reinvestment of these proceeds during the construction program generates earnings in excess of debt service requirements, these earnings would be credited to the capital program.

Table V, below, summarizes the year-by-year financing schedule for work other than rolling stock procurement. For the commuter railroads, federal funds will be available at a rate of $30 to $40 million a year. State funds freed up by refinancing commuter cars will be used as rapidly as possible. The West Side Storage Yard project will be financed as an early commitment against TBTA bonds to be sold under the 1979 authorization. The balance of financing will be accomplished by the various new bonding authorizations

under the 1981 Act. Since the entire $400 million in MTA revenue bonds for commuter rail purposes is required for rolling stock financing, the balance of the program will be from TBTA and ASC bonds. The mix and timing of types of bonds for this purpose is discussed in the next section of this report, but will be dependent on various factors including market conditions, the legislative intent on scheduling, and the extent to which various classes of bonds can be used for federal match.

The Transit Authority program section of Table V indicates a heavy reliance on federal funds, with the flow on a fairly regular basis over the five-year period. Because of the recent decision to reprogram the anticipated 1981 UMTA grant funds away from cars into other purposes, it is expected that this reprogramming would occur over two years, 1982 and 1983. State and "other" funds would be used in the early years as match for federal aid, while the funds from the City capital budget would be programmed for independent projects. The use of bond funds as match for federal aid, and for major non-federal programs, would commence in 1983. As in the case of the commuter railroads, virtually all the revenue bonds are committed in connection with the rolling stock program. The mix and timing of the balance of the TBTA and ASC bonds will depend on market conditions, eligibility for federal match and the legislative intent to defer debt service impact.

TABLE V
FINANCING SCHEDULE
OTHER THAN ROLLING STOCK
($ in millions)

	1982*	1983	1984	1985	1986	TOTAL
Commuter Program						
Commitments	215	137	215	195	204	966
Financing Sources						
Federal	30	30	33	36	40	169
State	85	59	-	-	-	144
TBTA '79	100	-	-	-	-	100
Other Bonds	-	48	182	159	164	553
Total	215	137	215	195	204	966
Transit Program						
Commitments	813	972	724	753	586	3,848
Financing Sources						
Federal	440	395	333	365	400	1,933
State	110	87	-	-	-	197
City	165	100	100	100	100	565
Other	-	90	-	-	-	90
TBTA '79	98	-	-	-	-	98
Other Bonds	-	300	291	288	86	965
Total	813	972	724	753	586	3,848

*Includes pre-1982 TBTA project commitments.

SUMMARY OF MARKETPLACE FINANCING DEMAND

Clearly, the most controversial element of the financing plan is its heavy reliance on capital funds generated in the private capital markets. Unlike legislative appropriations, such funds are available only on a competitive financing basis, with interest rates and supply clearly influenced by their quality as an investment. It is our intent to structure our approach to that market in a way that maximizes our ability to obtain funds on the required schedule. The schedule of borrowings, both through private placements for rolling stock and public sales for the balance of the program, is established in a way that begins with a rel-

atively small amount and relies upon established credits. In subsequent years, as our credit is established the program will be increased substantially but will aim to bring a regular and predictable volume of borrowings to the market each year so that they can be factored into the annual and quarterly plans of the investment community. If our initial experience with the lesser level of bonds indicates that legislative or programming change are required to improve our creditworthiness, these can be accomplished before the major financing occurs.

Table VI, below, integrates all of the private sector financing associated with the capital program. Financing the various items of rolling stock will require a total of $2,774 million including $480 million in lessor equity, $1,994 million in bonds for program purposes and $300 million in debt service reserve bonds. In the case of the program other than rolling stock, a total of $1,975 million in private sector financing is required, including $1,716 million in program funds and a debt service reserve of $259 million.

At its peak, this program will involve approximately $1.1 billion a year in private sector financing. However, the peaks and valleys are more with the negotiated rolling stock financing program. The public sales will occur on a fairly regular schedule of $400 to $500 million a year throughout most of the program.

Finally, the latter half of Table VI indicates a possible staging of the various classes of bonds, assuming that the revenue bonds are used for the rolling stock, that additional TBTA bonds are issued during 1981 for the projects now underway based on the 1979 authorizations, and that for the balance of the program the ASC bonds are given preference in timing in order to defer the impact of debt service requirements on the operating budget. As noted above, however, this schedule is merely illustrative, as it will undoubtedly vary according to market conditions and specific project financing needs.

TABLE VI
TOTAL PRIVATE SECTOR FINANCING
($ in millions)

	1982	1983	1984	1985	1986	TOTAL
Purpose						
Rolling Stock						
Lessor Equity	61	101	82	104	132	480
Bonds (including Reserve)	280	469	377	521	647	2,294
	341	570	459	625	779	2,774
Other Than Rolling Stock						
Need Based on Commitments (including Reserve Fund)	(228)	(401)	(544)	(514)	(288)	(1,975)
Proposed Issuance Schedule	350	400	500	500	225	1,975
Total Private Sector Capital	691	970	959	1,125	1,004	4,749
Consolidated Schedule of Bond Issuance (including Debt Service & Reserve Bonds)						
TBTA	200*	-	349	500	217	1,266
ASC	150	400	152	-	-	702
TA Revenue	136	246	283	521	655	1,841
MTA Revenue	144	223	93	-	-	460
Total	630	869	877	1,021	872	4,269

*Includes $57M issued in 1980, and potential issuance in late 1981.

Impact on the Operating Budget - As a further analysis, we are developing a cash-flow model which can account for the rate of bond issuance and capital outlay; the consequent rate of earnings on invested balances; and the build-up of debt service in the various operating budgets through direct charges or the indirect chargeback of TBTA debt service. At this point, all we can show is the ultimate debt service impact in some future year when the program has been completed, such as 1990. Based on the interest rate assumption of 12.75%, the annual net debt service charge to the NYCTA budget would be $296 million and the charge to the MTA commuter rail budget would be $110 million. In early years, the amount of debt service will be considerably less. In particular, it should be noted that the issuing totals reflected in Table VI will not impact the operating budget immediately, since reinvestment proceeds will offset debt service until the proceeds are spent.

While these are large sums in the aggregate, they should be put in the perspective of the MTA's total budget in future years. Projecting to 1990 and assuming a 10% rate of inflation, the combined TA/MTA operating expense budget would be approximately $5.1 billion. Assuming today's traffic volumes on the TA and commuter rail services, with a rate of revenue increase equal only to the rate of inflation (thus minimizing traffic loss), the combined agency revenues will be $2.6 billion. Absorbing a $400 million debt service item in an operation of such magnitude should be manageable. If our investments are planned with some attention to operating cost efficiencies and passenger attractiveness, a substantial portion of the investment could be covered without recourse to new sources of subsidy.

For example, if the 1990 projected expenses could be reduced by 5% below their anticipated level through planned operating economies, and if 1990 passenger volumes could be increased by 5% above today's level (a rate of increase of less than 1/2% a year), the combined decrease in costs and increase in revenues would cover 95% of the debt service costs.

These interrelationships between the capital program and the operating budget will be explored further, but the real prospect exists that some goal setting within the program and attention to its operating impacts could go a long way towards covering its costs. The ability to demonstrate such goals and the means of accomplishing them will be a substantial help in establishing the marketability of the bonds.

SECTION III C1

PRIORITIES

Use of the Matrix

THE MATRIX

The capital value matrix is a guide, or tool, used to assist in the establishment of relative priorities of individual projects.

The NYCTA matrix and the commuter rail matrix are on the following pages. The matrices are very similar in concept and logic. They differ in that the matrix of the commuter railroads, where higher fares are charged and length of trips is generally longer, places a slightly higher rating on passenger service/environment than does the NYCTA matrix.

Eight factors are considered in assigning a priority, or matrix value, to a project. They are - Safety, Reliability, Security, Maintainability, Passenger Service/Environment, Economics/ Cost Control, Public Interest and Employee Interest.

Each of the eight factors can have one of four degrees of impact. They are - Critically Important, Very Important, Important, No Impact.

Numeric values have been assigned to each of the eight factors. They range from 10 for Safety to 4 for Employee or Public Interest. Values have also been assigned to the degree of impact. They are 5 for Critical, 3 for Very Important, 1 for Important and 0 for No Impact. The computation to develop a composite value has been done and appears on the matrix.

To use the matrix, one would first identify the project or program and the capital cost. Then, going down the list of factors, one must determine the degree of importance for each factor. The appropriate value for each factor is entered in the space on the right-hand column in the Weighted Value column.

After each factor has been considered the Weighted Values are added to produce a Total Value. The Total Value is the matrix value or priority rating.

The matrix provides for consideration of negative impact by allowing negative values to be assigned to Category III - Important Needs.

The appendix provides "factor" weights and greater detail relative to the specific considerations.

CAPITAL VALUE MATRIX - NYCTA/SIRTOA

PROGRAM/PROJECT:

CAPITAL COST:

FACTOR	EXISTING NEEDS — CATEGORY I *Critically Important Needs*	VALUE	CATEGORY II *Very Important Needs*	VALUE	CATEGORY III *Important Needs*	VALUE	ITE LUE
SAFETY	Avoid serious injuries to individuals (See note 4)	+50	Remedy hazardous conditions involving large numbers.	+30	Otherwise improve safety.	±10	
RELIABILITY	Reduce MDS; meet service requirements; maintain operations.	+45	Reduce numerous disruptions; provide vital support; maintain operations.	+27	Otherwise improve reliability.	±9	
SECURITY	Reduce major crimes; implement major policies.	+35	Reduce other crimes affecting passengers	+21	Otherwise improve security.	±7	
MAINTAINABILITY	Replace components which are not maintainable.	+35	———		Parts difficult obtain; special inventories required.	±7	
PASSENGER SERVICES/ ENVIRONMENT	Relieve unreasonable overcrowding of services.	+30	Relieve unpleasant conditions affecting large numbers.	+18	Otherwise improve service and environment.	±6	
ECONOMICS/ COST CONTROL	Cost effective.	+30	Ratio of cost savings to capital cost between 0.5 and 1.0.	+18	Otherwise reduce system cost and avoid cost increase.	±6	
POLITICAL/ PUBLIC INTEREST	directives; persistent criticism; mandated.	+20	Considerable criticism.	+12	Some interest.	±4	
EMPLOYEE INTEREST	Union contract, remedy degrading conditions.	+20	Interest resulting in improved productivity; remedy inadequate working conditions.	+12	Improve employee facilities and work environment.	±4	

■ Prior to selecting the proper weighted values refer to the detailed description of needs on the following pages.

TOTAL VALUE ______

1. The numbers represent weighted values for each need.
2. The value for a factor shall be zero when a proposal does not have any impact on the needs within that factor.
3. An asterik (*) next to the total value indicates the project does not satisfy critically important needs.
4. In the event that safety is exceptionally critical, the safety portion of the rating is to be +100.

CAPITAL VALUE MATRIX - MTA COMMUTER RAILROADS

PROGRAM/PROJECT:

CAPITAL COST:

FACTOR	EXISTING NEEDS: CATEGORY I *Critically Important Needs*	VALUE	EXISTING NEEDS: CATEGORY II *Very Important Needs*	VALUE	EXISTING NEEDS: CATEGORY III *Important Needs*	VALUE	WEIGHTED VALUE
SAFETY	Avoid serious injuries to individuals.	+50	Remedy hazardous conditions involving large numbers.	+30	Otherwise improve safety.	+10	
RELIABILITY	Reduce service disruptions: Meet service requirements: Maintain operations.	+45	Reduce numerous disruptions: provide vital support; maintain operations.	+27	Otherwise improve reliability.	+9	
PASSENGER SERVICES/ ENVIRONMENT	Relieve unreasonable overcrowding of services.	+35	Relieve unpleasant conditions affecting large numbers.	+27	Otherwise improve service and environment.	+9	
MAINTAINABILITY	Replace components which are not maintainable or provide required maintenance facilities.	+35	______________		Parts difficult obtain: special inventories required.	+7	
SECURITY	Reduce major crimes; implement major policies.	+30	Reduce other crimes affecting passengers	+18	Otherwise improve security.	+6	
ECONOMICS/ COST CONTROL	Cost effective.	+30	Ratio of cost savings to capital cost is favorable.	+18	Otherwise reduce system costs and avoid cost increase.	+6	
POLITICAL/ PUBLIC INTEREST	persistent criticism; mandated.	+20	Considerable criticism.	+12	Some interest.	+4	
EMPLOYEE INTEREST	Union contract, remedy degrading conditions.	+20	Interest resulting in improved productivity; remedy inadequate working conditions.	+18	Improve employee facilities and work environment.	+4	

Prior to selecting the proper weighted values refer to the detailed description of needs on the following pages.

TOTAL VALUE ______

1. An item deemed to have an Exceptionally Critical Need receives double the Category Value.
2. The value for a factor shall be zero when a proposal does not have any impact on the needs within the factor.
3. The numbers represent weighted values for each need.
4. Prior to selecting the proper weighted values refer to the detailed description of needs.

AN EXAMPLE OF HOW THE MATRIX IS USED ON THE NYCTA

Project: Modernize Signal System - 116 Points

The procedure used in establishing a capital value for modernizing signal system.

1. Safety: A weighted value of 30 is assigned as modernizing the signal system fulfills a very important used of ensuring system safety.

2. Reliability: Signal system modernization meets a critically important need (weighted value 45) as it replaces the deteriorated signal system condition resulting in discontinuance or severe curtailment of mainline operation, or remedy existing conditions which could be the direct cause of major disruption of rapid transit service resulting from a single incident.

3. Security: A weighted value of zero is assigned as the signal system modernization does not affect security.

4. Maintainability: A weighted value of 35 is assigned as the signal system modernization fulfills a critically important need by modernizing the existing signal system which is not maintainable since it is beyond its economic life.

5. Passenger Services/Environment: A weighted value of zero is assigned as the signal system modernization does not affect passenger services or environment.

6. Economics/Cost Control: The signal system modernization meets an important need (weighted value 6) as it reduces operating costs resulting in some savings and maintains an efficient system operation.

7. Political/Public Interest: A weighted system modernization does not affect political/public interest. (Note: At the time the project rating was developed signal system components were not a matter of political interest.)

8. Employee Interest: A weighted value of zero is assigned as the signal system does not affect employee interest.

   Total value (sum of values items 1 thru 8) 116.

AN EXAMPLE OF HOW THE MATRIX IS USED ON THE LIRR

Project: Second Track - Northport - 170 points

1. Safety: - Category II (Very Important Needs) - 30 Points
"Remedy hazardous conditions involving large numbers."

- A single track operation has inherent safety aspects that are eliminated with double tracking. There is also the possibility of passenger injury occurring when large numbers of people are "stranded" (either on disabled trains or following trains) and cannot move, i.e., passenger refusal to follow established safety procedures and climbing between cars and/or locomotives or disembarking and roaming around near the electrified third rail.

2. Reliability: - Category I (Critically Important Needs) - 45 Points
"Reduce major disruptions of service; meet service requirements; maintain operations."

- A breakdown in a single track area stops all service through area, i.e., a major disruption of service. This affects stations as far away as New Hyde Park, since equipment providing service to these stations originates in single track territory. The increased operating flexibility provided by a two track line would make rush hour service more reliable by enabling the scheduling of trains on either or both tracks, when necessary.

3. Passenger Services/Environment: - Category I (Critically Important Needs) - 45 Points
"Relieve unreasonable overcrowding of services."

- Allows for increased passenger service in both directions in response to high passenger demand. today, there is no ability to serve reverse commuters at Port Jefferson and students at Stony Brook University and Hospital. In the morning, there is only one peak period train east of Huntington; there are none in the evening. (A four hour gap in westbound service exists from 4:00 PM to 8:00 PM on the diesel single track.)

4. Maintainability: - Not applicable.

5. Security: - Not applicable.

6. Economics/Cost Control: - Category II (Very Important Needs) - 18 Points
"Cost Savings benefit."

- Equipment and crew savings possible due to being able to recycle trains with second track.

- A single track branch limits the Railroad's effective use of its resources. Each train set able to double back could reduce MU car requirements. This is the potential to improve utilization of equipment; and additional productivity savings occur because the crew also doubles back with the trains.

7. Political/Public Interests: - Category I (Critically Important Needs) - 20 Points "
"Persistent criticism."

- Lack of bidirectional service in peak periods will be corrected. Frequency of off peak service will increase.

8. Employee Interest: - Category II (Very Important Needs) 12 Points
"Interest resulting in improved productivity."
- Increase use of employees; ease of operation with double track.

AN EXAMPLE OF HOW THE MATRIX IS USED ON METRO-NORTH

Project: DC Substation Modernization - 203 Points

1. Safety: - Category III (Important Needs) - 10 Points
"Otherwise Improved Safety"

- A weighted value of 10 was assigned because the nature of the improvements are in accordance with the goal to maintain a safe system operation for the commuters and employees.

2. Reliability: - Category I Doubled (Exceptionally Critical Needs) - 90 Points
"Reduce major disruptions of service; meet service requirements; maintain operations."

- As a result of these improvements system deterioration will be reversed and components can be kept in a state of good repair to insure safe, reliable commuter operations. Almost all of the present substations utilize obsolete apparatus and are in urgent need of replacement. The majority of them were placed in service prior to 1925 and utilize large rotary converters for which parts are no longer available.

3. Passenger Services/Environment: - Category II (Very Important Need) - 27 Points
"Relieve unpleasant conditions affecting large numbers."

- The existing electric traction system is at times responsible for air conditioning and other component failures in the electric rolling stock, as well as lower travel speeds through some sections of the Harlem and Hudson Lines. The contact rail which transmits the power from the substations to the cars is 70 lb/yd and has not been manufactured since the 1950s. The rail has deteriorated from exposure to the elements and service demands. The resulting severly reduced conductivity of the rail results in decreased train performance and problems with railcar systems. These problems, affecting air conditioning, motors, and propulsion controls are similar to those experienced by household appliances during a "brownout." Train performance, hampered because of low conductivity of the rail cannot deliver sufficient power to the cars is further reduced by substation failures. These failures produce areas in the system where there is so little power that operating trains lose up to 40 mph in speed and run at reduced speeds for long sections.

4. Maintainability: Category I Doubled (Exceptionally Critical Need - 70 Points
"Replace components which are not maintainable or provide required maintenance facilities."

- Hand in hand with the exceptionally critical need for improved reliability is the need to improve the maintainability of the system. The present condition of the antiquated electric traction system is beyond its useful economic life and replacement parts are no longer available.

5. Security: Not applicable.

6. Economics/Cost Control: - Category III (Important Need) 6 Points
"Otherwise reduce system costs and avoid cost increases."

- As a result of this program, operating savings of over $1 Million annually will accrue from the elimination of substation operators. All substations will be remotely controlled from the Control Center at 347 Madison Avenue.

7. Political/Public Interest: Not applicable.

8. Employee Interest: Not applicable.

SECTION III C2

PRIORITIES

Strategies in the Event of Reduced Funding

PROGRAM PRIORITIES - NYCTA

The Transit Authority in developing its Five Year Capital Program was restrained by the level of financial resources being made available. In allocating these resources to the elements of work identified in the Five Year Capital Program, the Authority prioritized its allocation to best match the needs of the system. In evaluating the needs of the system, the Authority used as the first priority, safety, followed by reliability, efficiency and commodiousness.

When evaluating a particular element in the Five Year Program which is projected to be more than 20% short of the original allocation, the Authority would have to evaluate that individual element and the status of all other elements in the entire program. For example, if certain elements are being committed at less than the original estimated cost, then an obvious solution is to reallocate those funds to those elements that are running over estimate.

A second aspect to be evaluated is where we are in the program at the time the shortage is identified. For example, if the shortage is identified after the 1984 program is committed, then only uncommitted funds would be available for the 1985 and 1986 programs. Once a particular contract is delivered those funds are no longer available, therefore, the decision process would have less flexibility in the out-reach years then it would in the beginning. However, conversely we do not have any better cost information today then has already been identified in the plan. Only time will prove out how accurate is our estimate of the effect of inflation and the level of competition for the array of projects we will be contracting out to the contracting industry.

In developing the needs of the transit system, the Authority evaluated the various elements of work in order to determine a life cycle for each individual element. It should be highlighted that the Transit Authority in many cases, is doing a first time replacement of the original equipment especially the various support elements such as, tunnel lighting, pumps, ventilation fans, emergency alarms, power cables, and signals. As a general rule, it could be held that equipment should be replaced on a 35 year cycle. However, in reality it is a more complex matrix as certain equipment will have a higher exposure as compared to other equipment. For example, tangent track may be required to be replaced every 20 to 25 years whereas track on sharp curves may be required to be replaced every 9 months. This is further compounded by the level

of traffic that may operate over the particular section of track. One main line operation there may be upwards of 30 trains per hour during the peak hour, while on branch lines this could be substantially less. Consequently, life cycles are dependent on particular circumstances, locations and usage as well as other factors such as technical obsolescence.

In the event capital funds are not sufficient to provide for the replacement cycle of all elements as identified in the program, the Authority would have to re-evaluate the life cycles as required taking into consideration the Authority's priorities of safety, reliability, efficiency, and commodiousness. If capital funds are not adequate on a timely basis the cost for increased inspection and maintenance and periodic repairs in order to keep the variety of equipment in service is funded out of the operating budget. This also further inpinges on the overall reliability on the system as the equipment ages.

In extreme situations, operating funds may have to be used to replace the equipment, especially if safety is affected.

Therefore, there is no one simple answer as to how the Transit Authority would re-program a particular element if the funding for that particular element would fall short by more than 20%. To repeat, the solution would be dependent on the particular instance in time when the shortfall is discovered, the particular element wherein the shortfall occurred and the status of the remaining program as regards to the commitment of funds. In summary, when dealing with the transit system, it should be dealt with as a total system and not as a series of incremental elements.

The following is the approach the Authority would use for each of the categories.

Cars -

1) Reduce the number of IND/BMT cars to be purchased.

Buses -

Reduce the number of buses to be purchased.

Passeenger Stations -

Reduce the number of stations to be modernized and/or modify the scope of work.

Track -

Reduce the noise reduction elements.

Line Equipment -

Defer selected projects.

Line Structures -

Defer selected projects.

Signals & Communications -

Reprogram funds from other categories.

Power -

Defer equipping IND substations.

Shops -

Reprogram funds from other categories.

Yards -

Reduce yard fencing and security.

Defer Yard expansion.

Depots -

Reprogram from other categories.

Service Vehicles -

Reprogram from other categories.

Security Systems -

Reduce the number of stations.

New Routes -

Defer Archer Avenue/Jamaica.

PROGRAM PRIORITIES ON THE LIRR

The priorities established for LIRR projects were based on the capital value matrix. To the extent possible, this will continue to be the basis for priorities. Should there be a short fall of funding for particular elements, where feasible, that element would be cut back. Only a few of the elements can be deferred into the future and still provide meaningful passenger benefits.

Within the Passenger Station Program, for instance, should a short fall exist in this program, the final years could be scaled down and the particular stations to be improved in that year would have to be done in the subsequent Five Year Program.

Within the Line Structures element, it may be feasible to extend the implementation of several of these programs into the next five year period. The Jamaica and Penn station interlocking improvements implementations could, if funding runs short, be spread out accordingly into the future. This would also be true of the Central Control. These projects will be developed in phases, and therefore, should it be necessary, their implementation could be extended.

The Security System improvements may also be reduced in the later years if funding becomes short. The design for Harold Interlocking could be put off, but this would further delay improvements in this area.

There are also many projects that cannot be scaled down and still achieve passenger benefits. These include the extension of electrification to Northport and the West Side Yard. The extension of the Ronkonkoma second main track could be shortened if absolutely necessary but a major portion of the benefits would be lost. However, the major growth has been occurring at the extreme east end and the market for service improvement is at the east end deep in Suffolk County. The purchase of cars should not be reduced, as this program is cost effective considering the existing contract. The cars are vitally needed both for today's and projected ridership demand. The cars represent the backbone of the entire program. In the same way, the Shop Program is a comprehensive plan where each phase supports the following in a way that will overcome the long overdue upgrading of the maintenance facilities, and therefore should continue according to the Master Plan.

PROGRAM PRIORITIES ON METRO-NORTH

In the event that the Five Year Capital Program is subjected to shortfalls of any size, due to the inability to sell the requisite amount of bonds to finance the program, the matrix values which were used to assign the priority would be utilized to determine the elements to be reduced. If funding for the entire program was reduced by 20% or more, naturally all programs would have to be scaled down to a level which permits only those improvements which are critical to the operation of the commuter service.

On the other hand, if only a specific element were to be subjected to the shortfall a slightly different procedure would be followed which would optimize the amount of work performed while facilitating the completion of the work at a later date. The following is a specific identification of the work that would be eliminated and/or deferred in the event of a shortfall for each category.

The purchase of New M-3as for the Harlem and Hudson Service and New M-2´s for the New Haven Line is the major cost item in the Five Year Program. since the commitment has already been made for the original 60-M-3a cars, there will be no reduction in that portion. However, in the event that the shortfall occurs within the first 2 years of the program the number of optional M-3as and M-2´s purchased would have to be scaled down. Since it is anticipated that the funds for all new cars will be committed by 1983, any shortfall which occurs after the commitment of these funds would have to be applied to other elments of the program.

A 20% or more reduction in the first two years of the program in the car rebuilding element would result in a reduction of the number of 4400 series electric cars rebuilt for diesel hauled service. Once again the commitment of these funds in the first two years of the program makes it necessary to apply reductions after 1983 to other programs.

With the Upper Harlem Electrification progressing on schedule, the Authority is committed to the expenditure of the $17 million for the construction of high level platforms at the Upper Harlem Line Stations. If the element funding is reduced, the remaining 6.3 million designated for station improvements including access for the elderly and handicapped improvements over and above the revised amount of funding available must be deferred to the post 1986 period.

The Harmon to Poughkeepsie track improvement program is presently funded at sufficient level to complete the installation of all

continuously welded rail. In the event that the Line Structures catgegory is reduced by 20% or more the funding for the ancillary work associated with the rail replacement such as bridge rebuilding, curve realignment, turnout installation, etc. may be reduced. In addition, the interlocking improvements and bridge and tunnel rehabilitation work would be restricted to only those areas where there is a critical need for repair or replacement to continue operation. All work upgrading or enhancing the existing conditions will have to be deferred.

The Signal Improvement Category includes the completion of all signal work between Mott Haven and Brewster North and Mott Haven and Croton Harmon. If funding is scaled back by 20% or more, the engineering will be completed for all the work and all materials will be purchased. Actual installation of the materials will be progressed as far as possible with the remaining work deferred into the post five year period. While this increases the overall cost of the program, it permits uninterrupted construction once the additional funding is made available.

The electric traction power category contains several elements which are already the result of the past practices of deferring maintenance improvements. If the power elements are subjected to new shortfalls some of the work will have to be deferred into the post 1986 period. The Cos Cob Power Plant improvements are to be progressed as soon as the funding is received to prevent total collapse of the New Haven Line traction power system. Unless this element is reduced at the onset of program the Cos Cob Power Plant improvements will not be affected. The substation and third rail modernization, however, will be reduced in scope to include the design of all substations, the purchase of all materials and the installation of only those substations and third rail which are presently adversely affecting operations, beginning with those in worst condition and working up to the least troublesome obsolete equipment.

It is anticipated that funds for the rehabilitation of Harmon Shop will be committed in mid 1982. As a result of this commitment funding for Harmon Shop cannot be reduced. Any subsequent shortfalls in the Shop/Yard Category must be applied to the other improvements. Yard work would be limited to those areas currently causing disruptions of service or are critical to the continuation of service. Shop improvements at the Grand Central Terminal and Poughkeepsie maintenance of equipment areas would be deferred. Maintenance of Way facialities would be improved only to the extent where current unsafe or inadequate facilities exist. Facilities which presently are served by temporary trailers would be deferred until sufficient funding became available.

The Upper Harlem Electrification is a Class B program. As such any shortfalls in this element would by necessity come from the contingency/emergency element.

Should the entire $684 million program be reduced by 20% or more, the matrix values would be used to the extent possible starting with the lowest priority item and working up list. Exceptions to this procedure would be improvements which have become critical to the operation of the commuter railroad such as a major structural failure in the Park Avenue Tunnel or complete loss of use of a substation or interlocking. Those items would have to be replaced to maintain services.

SECTION III D

PROGRAM DETAILS

- NYCTA
- SIRTOA
- LIRR
- Metro-North

NYCTA PROGRAM DETAIL

CATEGORY: Cars, New CATEGORY: T-1

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Purchase IRT and BMT/IND Cars (CM09)	146	1377*	-	372	--	--	1,749	

CATEGORY Cars, Rebuilt/Rehabilitation CATEGORY: T-2

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Modernize Car Door Systems (CM02)	100	10	12	18	--	--	40	
Retrofit existing cars with air conditioning (CM06)	32	-	1	1	-	-	2	
Purchase and install intercar safety barriers on 75 ft. cars (CM10)	14	--	0.3	--	--	--	0.3	
Car rehabilitation and enhancement program (CORE) (CM 11)	146	69	65	65	65	65	329	

CATEGORY: Buses CATEGORY: T-3

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Purchase new buses (SF02)	146	54	59	64	66	69	312	

* Includes $345M for 325 IRT car carry over from 1981.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect

NYCTA PROGRAM DETAIL

CATEGORY: Passenger Stations — CATEGORY: T-4

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
		COMMITMENTS PER CALENDAR YEAR						
Replace overage escalators (MW03)	70	5	1	--	0.1	2	8	
Replace/Rehabilitate elevators (MW05)	*	0.2	3	--	--	--	3	
Replace platform roofs and canopies (MW23)	*	0.3	7	7	11	9	34	
Power for Emergency lighting (MW25)	96	--	1	1	1	1	4	
Replace turnstiles (MW34)	44	--	1	2	2	--	5	
Replace incandescent station lighting with flourescent (MW36)	49	7	--	0.1	3	9	19	
Station Modernization (ST02)	58	45	37	47	49	49	227	
Install abrasive warning strips (ST05)	36	--	1	--	--	--	1	
Provide improved station signage (ST06)	38	0.4	8	--	--	--	8	

CATEGORY: Track — CATEGORY: T-5

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
		COMMITMENTS PER CALENDAR YEAR						
Rehabilitate mainline track (MW26)	116	41	45	42	42	38	208	
Modernize/replace track switches (MW28)	116	11	13	7	13	5	49	
Weld rail on subway tracks (MW44)	63	8	13	20	12	15	68	
Install rubber rail seats (MW45)	63	6	4	5	3	3	21	
Replace contact rail (MW11)	96	0.1	3	12	3	1	19	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA PROGRAM DETAIL

CATEGORY: Line Equipment CATEGORY: T-6

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace existing tunnel lighting systems (MW18)	36	0.4	10	2	6	7	25	
Rehabilitate/replace pumping facilities (MW19)	78	1	13	--	1	0.1	15	
Rehabilitate ventilation facilities (MW24)	78	7	2	32	--	0.3	41	
Rehabilitate power facilities (MW25)	96	0.2	5	1	5	5	16	

CATEGORY: Line Structures CATEGORY: T-7

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Remedy water conditions (MW12)	*	5	10	14	6	5	40	
Replace wooden platforms (MW20)	64	7	1	6	--	1	15	
Rehabilitate structures various lines (MW22)	*	31	15	31	42	22	141	
Replace discharge, fire and water lines (MW30)	63	1	--	0.1	1	1	3	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA PROGRAM DETAIL

CATEGORY: Signals and Communications CATEGORY: T-8

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Replace signal relay code system (MW14)	85	0.3	7	9	8	3	27	
Modernize telephone cables and equipment (MW17)	85	3	4	3	10	6	26	
Modernization of signal system (MW38)	116	7	145	50	134	76	412	
Antenna cable replacement (MW42)	85	--	1	7	6	4	18	
Install Maintenance of Way communication system (MW43)	85	--	--	--	1	16	17	

(Columns 1982–1986: COMMITMENTS PER CALENDAR YEAR)

CATEGORY: Power CATEGORY: T-9

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Replace/modernize/ add substations on IRT/BMT system (PW02 & 03)	96	52	70	41	51	46	260	
Re-equip IND sub-station with silicon rectifiers (PW04)	96	8	9	11	12	-	40	
Modernize elevators at 126 W. 53 St. Substation (MW05)	45	--	--	--	1	--	1	

(Columns 1982–1986: COMMITMENTS PER CALENDAR YEAR)

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA PROGRAM DETAIL

CATEGORY: Shops

CATEGORY: T-10

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
		COMMITMENTS PER CALENDAR YEAR						
Advance a continuing shop modernization /rehabilitation program (CM03)	*	17	163	110	50	38	378	
Replace outmoded and inefficient mechanical and motorized shop equipment (CM05)	64	0.1	2	1	—	—	3	
Replace/rehabilitate elevators in shop buildings (MW05)	*	—	0.3	0.4	—	—	1	
Replace outmoded and inefficient maintenance of way equipment and machinery (MW06)	64	0.5	0.2	0.2	0.2	0.2	1	
Rehabilitate employee facilities (MW08)	55	0.1	0.1	0.1	0.1	0.1	1	
Construct new maintenance shop facilities (MW27)	*	—	0.2	1	2	3	6	
Advance a heating system and boiler replacement program (MW29)	72	2	0.1	2	3	1	8	
Rehabilitate shop buildings (MW33)	*	12	0.1	2	1	7	22	
Repair/replace roofs of various shops (MW41)	*	2	0.3	5	2	3	12	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

CATEGORY: Yards — CATEGORY: T-11

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Rehabilitate yard facilities (MW09, PP02)	72	4	91	27	27	68	217	
Replace contact rail (MW11)	96	0.1	3	12	2	1	18	
Rehabilitate power facilities (MW25)	96	--	1	1	1	1	4	
Install new hydrant system (MW30)	63	0.4	--	0.1	0.4	0.4	1	
Yard lighting (MW31)	61	0.1	0.5	0.6	0.5	0.8	2	
Construct additional storage tracks (MW33)	*	2	--	--	--	--	2	
Yard expansion/ improvements (TR03)	*	8	19	24	55	0.4	106	

CATEGORY: Depots — CATEGORY: T-12

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace base stations and radio systems (SF03)	85	11	5	6	3	3	28	
Replace mechanical and motor equipment (SF04) (MW06)	64	5	1	1	1	1	9	
Construct new and additional bus depots and repair facilities (SF06)	*	54	94	26	58	43	275	
Modernize/rehabilitate bus depot and repair facilities (SF07)	*	2	43	10	--	--	55	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA PROGRAM DETAIL

CATEGORY: Service Vehicles

CATEGORY: T-13

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace maintenance equipment and machinery (MW06)	64	2	1	1	1	1	6	
Replace automotive trucks and service vehicles (MW07 SF05)	*	1	1	0.4	1	0.7	4	
Replace/add work trains (MW10)	60	43	—	—	—	0.4	43	

CATEGORY: Security Systems

CATEGORY: T-14

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Station annunciators, improvements to waiting areas; CCTV (PL03)	63	4	4	4	4	5	21	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NYCTA PROGRAM DETAIL

CATEGORY: New Routes — CATEGORY: T-15

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Construct and equip new Queens routes (EN12)	59	169	7	4	—	—	180	

CATEGORY: Emergency/Miscellaneous — CATEGORY: T-16

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Management Information System (IE-02)	6	6	6	5	2	1	20	
Emergency, Contingencies, and Miscellaneous Individual Projects (MW-01, MW0-8, MW27, MW29, MW33, MW41, PL01, ST01, TR01, TR02)	*	41	37	41	48	52	219	

*Varies depending upon individual project within the program.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SIRTOA PROGRAM DETAILS

CATEGORY: PASSENGER STATIONS — CATEGORY: S-1

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Station Rehabilitation; Pleasant Plains and Princess Bay	64	-	-	-	-	3.20	3.20	
Extend platforms at six stations; Dongan Hills to Great Kills	Varies	0.96	-	-	-	-	0.96	
Extend platforms at five stations; Eltingville to Atlantic	Varies	-	-	1.68	-	-	1.68	

CATEGORY: TRACK — CATEGORY: S-2

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Track and Contact Rail Replacement; various locations	116	0.33	0.36	0.40	0.44	0.48	2.1	
Realign "wye" track at St. George	116	0.28	-	-	-	-	0.28	

CATEGORY: LINE EQUIPMENT — CATEGORY: S-3

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace Tottenville Interlocking	116	-	-	-	3.0	-	3.0	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

SIRTOA PROGRAM DETAILS

CATEGORY: POWER

CATEGORY: S-4

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Supervisory Control of Equalizer Breakers	96	-	-	-	-	0.90	0.90	
Substation Equipment	96	-	9.03	-	-	-	9.03	
Substation Enclosure	96	1.10	-	-	-	-	1.10	

CATEGORY: SHOPS

CATEGORY: S-5

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace Machine Tools	64	-	0.60	-	-	-	0.60	

CATEGORY: SECURITY

CATEGORY: S-6

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Replace Cyclone Fencing; various locations	32	0.06	0.06	0.07	0.07	0.08	0.34	

CATEGORY: MISCELLANEOUS

CATEGORY: S-7

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Misc. Emergency Repairs		0.30	0.40	0.40	0.40	0.40	1.9	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LIRR PROGRAM DETAIL

CATEGORY: CARS, NEW — CATEGORY: L-1

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Purchase of up to 216 new M-3 Electric Passenger Cars.	186	252.5	-	-	-	-	252.5	(1)

(1) Includes 70 M-3 cars previously ordered at a cost of $77.5M.

CATEGORY: PASSENGER STATIONS — CATEGORY: L-2

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Penn Station Passenger Access	158	1	2	5	7	-	15	
Various Station Improvements	121	.4	1	.2	-	7	8.6	
Landia Station	121	.6	1	4	1	1	7.6	

CATEGORY: TRACK — CATEGORY: L-3

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Additional track to Northport.	170	-	4	12.4	7	4	27.4	(1)
		1.2	-	-	-	-	1.2	(2)
Additional track to Ronkonkoma	170	-	9	15.5	14	10	48.5	(1)
		1.6	-	-	-	-	1.6	(2)

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information only.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LIRR PROGRAM DETAIL

CATEGORY: LINE STRUCTURES — CATEGORY: L-4

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Modernize Jamaica Interlocking including	165	-	2	9.2	20	13	44.2	(1)
Central Control		.9	-	-	-	-	.9	(2)
Modernize Penn Station Switching and Control.	164	-	2	2	9	9	22	
Upgrade Divide Interlocking	130	1	-	-	-	-	1	

CATEGORY: SIGNALS — CATEGORY: L-5

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
Jamaica to Penn Station Reverse	181	-	-	4	10	4.5	18.5	(1)
Signalling, including Harold Interlocking		4	4.7	-	-	-	8.7	(2)
Signal Improvements on the Montauk Branch	132	-	-	3	3	4	10	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

September 25, 1981

LIRR PROGRAM DETAIL

CATEGORY: SHOPS/YARDS CATEGORY: L-6

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Shop Improvements in accordance with	181	18	26	27	15	15	101	(1)
the Maintenance Facilities Master Plan Study.		41	35	0	0	0	76	(2)
Construction of West Side Storage	184	16	30	12	-	-	58	(3)
Yard.		54	-	-	-	-	54	(4)

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information purposes only.
(3) Total of $58 million represents new money available for this program.
(4) For information only. Indicates commitment schedule for "pre-1982" funding. Does not include $46 million already committed or to be committed prior to 1982.

CATEGORY: SECURITY CATEGORY: L-7

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Security Improvements	127	.5	0	1.1	.7	.8	3.1	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

LIRR PROGRAM DETAILS

CATEGORY: ELECTRIFICATION/EXTENSIONS CATEGORY: L-8

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Electrification	138	-	8.3	13.0	12.0	2.4	35.7	(1)
to Northport		1.3	-	-	-	-	1.3	(2)

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information purposes only.

CATEGORY: MISCELLANEOUS/EMERGENCY CATEGORY: L-9

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Misc. Emergency Repairs		2.9	2	10.5	3.5	11	29.9	(1)

(1) It may be necessary to draw down these funds earlier than actually shown in the case of extreme emergency.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH PROGRAM DETAIL

CATEGORY: CARS — CATEGORY: M-1

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
		COMMITMENTS PER CALENDAR YEAR						
Purchase of 142 new M-3a cars.	214	164.5	-	-	-	-	164.5	(1)
Purchase 10 SPV cars	214	12	-	-	-	-	12	(2)
Purchase of 44 new M-2 Electric Passenger Cars.	214	-	71.6	-	-	-	71.6	
Rebuild 24-4400 series cars	123	-	12	-	-	-	12	
Equip 7-FL9 locomotives with Head End Power	122	1.4	-	-	-	-	1.4	
Replacement of M-2 Transformers or rebuild MU Cars	99	16	-	-	-	-	16	

(1) Includes carry forward for purchase of 60 cars ordered in 1981 at a cost of $66.5M.
(2) Includes carry forward for purchase of 10 cars ordered in 1981 at a cost of $12M.

CATEGORY: PASSENGER STATIONS — CATEGORY: M-2

PROJECT DESCRIPTION	MATRIX VALUE	1982	1983	1984	1985	1986	TOTAL	NOTE
		COMMITMENTS PER CALENDAR YEAR						
High Level Platform on Upper Harlem Line.	124	17	-	-	-	-	17	
Misc. Station Improvements.	40	1.5	-	1.6	.5	2.7	6.3	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH PROGRAM DETAIL

CATEGORY: LINE STRUCTURES CATEGORY: M-3

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Interlocking Improvements	67	-	3	7.2	5	5	20.2	(1)
Harmon to Poughkeepsie	61	4	-	-	-	-	4	(1)
Track Improvements		8	-	-	-	-	8	(2)
Bridge and Tunnel Rehabilitation	52	-	-	2.1	.5	2.4	5	

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information purposes only.

CATEGORY: SIGNALS CATEGORY: M-4

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Hudson Harlem Cab Signalling	197	-	10	20	22	22	74	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

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METRO-NORTH PROGRAM DETAIL

CATEGORY: POWER

CATEGORY: M-5

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Hudson/Harlem Substation and Third Rail Modernization	203	5	20	45	55	65	190	(1)
		1.8	-	-	-	-	1.8	(2)
Cos Cob Power Plant Improvements	159	2.5	-	-	-	-	2.5	
Misc. Electric Traction	34	-	-	.5	.5	-	1	

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information purposes only.

CATEGORY: SHOPS/YARDS

CATEGORY: M-6

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Harmon Shop Improvements	235	10	-	-	-	-	10	(1)
	-	9	-	-	-	-	9	(2)
Miscellaneous M-1 Shop Work at Brewster, NWP, GCT and/or Poughkeepsie. New Maintenance of Way at Mott Haven and North White Plains facilities	77	2	3	6.2	4	5	20.2	
Misc. Yard and Shop Improvements	42	.2	.0	.8	1	3	5	

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

METRO-NORTH PROGRAM DETAIL

CATEGORY: ELECTRIFICATION CATEGORY: M-7

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Upper Harlem Electrification	180	10	-	-	-	-	10	(1)
		15.5	-	-	-	-	15.5	(2)

(1) Excludes "pre-1982" funds.
(2) "Pre-1982" funds for information purposes only.

CATEGORY: MISCELLANEOUS CATEGORY: M-8

PROJECT DESCRIPTION	MATRIX VALUE	COMMITMENTS PER CALENDAR YEAR 1982	1983	1984	1985	1986	TOTAL	NOTE
Misc. Emergency Repairs		5	2	10.5	7	16.8	41.3	(1)

(1) It may be necessary to draw down these funds earlier than actually shown in the case of extreme emergency.

Costs in millions of dollars, escalated at 10 per cent per year from 1980 to reflect inflation.

NOTE

(1)

(2)

NOTE

(1)

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